The

Journal of Agriculture.

WELLINGTON, NEW ZEALAND.

20TH MAY, 1918.

POTASH IN AGRICULTURE.

IV. BETTER NEWS.

B. C. ASTON, F.I.C., Chemist to the Department.

SINCE the third article of this series was published in the *Journal* for June, 1917, the potash situation in Great Britain and the Americas had taken on a brighter outlook, and the tone of those authorities in the countries of the Allies who discuss fertilizer problems is distinctly more hopeful when speaking of Germany's control of the natural potash deposits in Europe. This is no doubt due to the situation having been faced by British and American scientific men, who are now finding, after investigating very diverse sources of potash, that there is every prospect of being able to meet the shortage from internal sources if methods for potash-saving are followed up. It is significant that one of the most promising sources is from a hitherto neglected waste product, and in this connection one is reminded of the large waste-heaps of slag from the Bessemer ironworks, which were a nuisance until it

was discovered that the phosphate which the slag contained was of great value when applied to the land with merely a preliminary grinding of the slag, now universally known as basic slag, or Thomas phosphate. Curiously enough, it is to the same industry that science now looks with so much expectation as a source of available potash—the blast-furnaces of the British and American ironworks.

POTASH FROM IRONWORKS.

A large proportion of the iron-ores of America contain approximately 0·0025 per cent. of potash, a few running as high as 2 per cent. The coke used in fusing the iron contains another 0·0025 per cent. of potash, and the limestone flux 0·01 per cent. Twenty-two pounds of potash are thus fed into the furnaces for every ton of pig iron produced. About one-fifth of the potash passes into the slag and is not recoverable, but the balance goes up into the flues as fume. This fume contains the potash largely in an available (water-soluble) condition, and it can be recovered by means of various electrical and mechanical contrivances.

As the pig-iron production of the United States is about twenty-five million tons yearly (*Scientific American*, 20/10/17), it will be seen that the saving and utilization of this waste potash will be one of the good things which has already come out of the war. The alkaline dust recovered in three months by one blast-furnace concern in America (*Jour. Soc. of Chem. Ind.*, 1917, p. 327) amounted to 1,073 tons, and from it 106 tons of water-soluble potash was obtained. By using a Cottrell electric dust-precipitator all the dust may be precipitated and thus saved.

Berry and McArthur (*J.S.C.I.*, 1918, p. 1 T) find that much less potash is recoverable from British blast-furnaces, but stress the point that their figures are only appliable to the plant and raw material with which they experimented. As the production of potash from blast-furnaces has only an indirect interest for New Zealand, where there are practically no ironworks, it may be stated that while American experience points to a saving of 17 lb. of potash for every ton of pig iron produced, Berry and McArthur's figures show less than one-half this, or 7·6 lb. They, however, point out that the requirements of the British Isles for potash are 32,000 tons per annum, and there is good reason to believe that if all the sources of potash in Britain they mentioned were developed to the fullest extent the country's requirements in potash would be more than met.

Sir A. D. Hall, F.R.S., Permanent Under-Secretary to the English Board of Agriculture, lecturing at the London School of Economics (*J.S.C.I.*, 1918, p. 30 B), made a somewhat higher estimate of Britain's

potash requirements, which he says are at least 40,000 to 50,000 tons annually, but he also believes that the recovery of potash from blast-furnace gases would go some way to meet the present shortage. A maximum of 15,000 tons could be expected, which would be sold at 10s. per unit K_2O.

The British Food Production Department, in conjunction with the Ministry of Munitions, has invited application from farmers for the purchase of blast-furnace dust of various grades from 3 to 13 per cent. soluble potash (K_2O), at from £1 17s. 6d. to £5 0s. 6d. per ton, bagged, farmers having to undertake to use the dust themselves as a manure, and not to sell it to any other person (Jour. Bd. of Agric., England, Nov., 1917, p. 852).

POTASH FROM CEMENT-WORKS.

Portland cement is manufactured by heating to a state of semi-fusion a mixture consisting of definite proportions of lime or limestone with clay or marl. All of these ingredients contain potash silicates as an impurity, and when coke or coal is used in the old-fashioned kiln for heating, this contributes its modicum of potash to the general result. Liquid fuel is, however, more generally used in modern works for "clinkering" the mixture, as the process is termed. The clay used may contain 1, 2, or even 4 per cent. of potash in the insoluble state combined with silica. When heated with the large amount of lime used much of the potash is driven off from the clinker as a fume, and either condenses as a fine crystalline sublimate on the walls of the flue or is carried out up the smoke-stack with the other products of combustion, steam and smoke. Reckoning that there is 1 per cent. of potash in the material fed into the kilns in the insoluble siliceous state, less than one-half of which is volatilized, the remaining half being fixed in the cement clinker, for every barrel of cement made, 6 lb. of potassium sulphate can be recovered by appropriate methods. A full account of the method, which includes the use of electric precipitators, was published in the *Scientific American* of 13th October, 1917. At the Hagerstown works of the Security Cement Lime Company, in America, a Cottrell plant was installed in 1916 for the recovery of the potash from the kiln-gases by the aid of high-tension current of 70,000 volts. With two kilns 7 ft. by 100 ft. and three of 8 ft. by 125 ft. the production of dust averages from 20 to 25 tons a day of twenty-four hours. The dust contains 5 to 10 per cent. of potash in the form of potassium sulphate, and in a very finely divided state (*J.S.C.I.*, 1917, 36, p. 327). The full details of the electrical equipment may be consulted in the journal quoted.

The recovery of potash from cement-works waste products is within the bounds of practical politics in New Zealand, as the Dominion's output of Portland cement is about 80,000 tons a year, or 400,000 barrels (American measure). If potassium sulphate is recoverable from New Zealand Portland cement in the same ratio as that of the American experience quoted above, the 80,000 tons (= 400,000 barrels) should yield as a by-product 6 lb. × 400,000 = 1,070 tons of potassium sulphate, or about as much as was imported from Germany to New Zealand in the year before the war (1,088 tons). The matter is certainly worth looking into, and inquiries are being made with a view to testing the idea.

MINERAL SOURCES OF POTASH.

Sir Edward Thorpe, at one time principal Government Chemist in Great Britain, recently discussed (in *Nature*, 3/1/18) the sources of potash, and was inclined to concur in the general conclusions of Mr. E. A. Ashcroft, who discovered and studied a method whereby potash feldspar when partially fused or fritted with common salt was found to yield the potash as potassium chloride. He concluded that from a purely commercial point of view the attempt to work the Scottish deposits of feldspar seems fully justified. The extraction of potash as a primary product from the inert rock silicates would seem to be a fascinating subject for patentees, as it is stated that upwards of one hundred patents dealing with this have been taken out in the United States alone. The conditions in Scotland may be different, but Hall states that the success of the process of extracting soluble potash from the Cornish feldspar* was to a large extent discounted by the fact that the yield was very low in proportion to the amount of white cement obtained as a by-product, 100 tons of feldspar giving about 8 tons of potash and 220 tons of cement, and the market for the latter was limited, as it was only suitable for indoor purposes. This difficulty of the utilization of by-products when potash is made the chief objective must be a very real one, and it will be realized how much more rational it must be to save the potash now wasted in existing manufactures rather than to try and create new ones having potash as the main objective, when the output of main product is so small compared with the by-products for which a use has to be found. A valuable summary of our knowledge of native deposits of soluble potash salts is given in Thorpe's article, from which we learn that Germany is so carefully regulating the Alsatian deposits of potash that only 80,000 tons are permitted to be sold, whereas the mines are

* The report on the organization set up by the Imperial authorities in connection with this industry is very instructive, and may be consulted in the *Journal of the Board of Agriculture*, England, February, 1917, p. 1087.

capable of turning out ten times this quantity. The Spanish deposits, which are estimated to contain in the area explored three and three-quarter million tons of potash salts, are at present not utilized, owing to the influence of Germany in Spanish affairs. An attempt to obtain a supply of the Spanish potash for New Zealand was met with the reply that the export of potash salts had been prohibited since 1st August, 1915. The Abyssinian deposits belong to Italy, but the distance from the coast (90 kilometers) and the hostility of the Natives renders the exploitation of the deposits difficult. They, however, furnish 20,000 tons yearly.

Attention is drawn to conditions such as probably have produced the Stassfurt deposits, which are still at work in several parts of the world, operating over large areas, as, for example, in Adji-Darja Bay, on the east of the Caspian Sea, an area 2,000 to 3,000 square miles in extent and almost entirely shut off from the Caspian Sea by a bar. There is here a continuous separation of salt, estimated by Schleiden to be about 400,000 tons a day, with an outflow of dense mother liquor (containing the potash) back to the Caspian, except where it sinks into the deeper parts of the bay, where the mother-liquor salts are gradually deposited.

In connection with native deposits it is of interest to learn from the report of the Commonwealth Advisory Council of Science and Industry to 30th June, 1917 (see *J.S.C.I.*, p. 1078, 1917), that the most satisfactory solution of the potash difficulty would be the discovery in Australia of a saline deposit rich in potash salts. It seems, they say, not improbable that such a deposit might exist in some of the lake-basins of Central Australia.

The same body has issued a bulletin on the alunite deposits of Australia, the most extensive in the world (Bulletin No. 3, Melbourne, 1917). As is the case with the manufacture of potash from feldspar in Cornwall, a difficulty in the successful manufacture of potash from alunite in Australia would seem to be the utilization of the large alumina by-product, a difficulty also experienced in America. Alunite is a mineral which has been described in previous articles in the *Journal*,* and it will be sufficient to say that, by a simple process of heating, the potash it contains may be made soluble and will give at least as good results as the equivalent amount of potash in the usual German potash salts. Taking advantage recently of the presence in Australia of the Director of the Horticulture Division, he was asked, at the writer's request, to inquire into the possibility of obtaining a supply of alunite for New Zealand; but he reported, after interviewing the

*Previous articles on potash in this *Journal* are to be found in the issues of July and October, 1915; December, 1916; and April and June, 1917.

Victorian Chemist for Agriculture and the officers of the Advisory Council of Science, that there was no chance of getting alunite from Australia at present. A subsequent inquiry of a large commercial house in Australia elicited the same disappointing reply. As alunite has been found in New Zealand there is a probability that it may be yet found here in a workable quantity. Prospectors might familiarize themselves with the mineral, which no doubt will be found to be exhibited in any of the four chief museums of the Dominion.

The United States of America is endeavouring to meet the potash shortage with energy. This is necessary, as there is much intensive cultivation requiring heavy potash fertilizing. From mineral sources—brines, silicate rocks, alunite, and furnace-dusts—5,750 tons of potash (K_2O) were obtained, and from organic sources—kelp, wood-ash, and miscellaneous wastes—3,080 tons, a total of 8,830 tons. The saline deposits from the Nebraska lakes furnished the largest output, but salines in other districts are making important contributions. Kelp only furnished 1,110 tons. The Geological Survey now reports greatly increased production of potash in the country for 1916, it being ten times that of 1915. In recent years the United States has taken one-fifth of the entire output of the German mines, and one-half of all allowed to be exported, buying thus in 1913 one million tons of potash salts. In December, 1913, the price of muriate of potash in America was 39 dollars a ton, but in December, 1915, it was quoted at 500 dollars, with only small lots available. (Year-book, U.S. Dept. of Agric., 1916, p. 312.)

SUPPLY OF POTASH IN NEW ZEALAND.

During the past year attempts have been made to secure some of the potash which is at present wasted, as that was the method of obtaining potash which commended itself as being most likely to have a successful issue. Accordingly, the author has written to all the sawmillers and wood-workers, who, in the aggregate, produce a large amount of ashes derived from the waste wood used as fuel. It was pointed out to them that by saving and bagging the wood-ashes, which should be kept dry, and sold to those desiring them, they would help in the work of increasing primary production by means of utilizing a waste product. Apparently there have been difficulties in the way of the suggestion at most mills, as the response has been much below expectation. Two firms, however, showed willingness to save the ashes and bag them, and so far every bag they have collected has been disposed of at the price which they required. One producers' association took up the matter energetically, and has received several consignments of ashes as a result of sending a

representative to the timber-mills, explaining what was wanted, and generally following up scientific advice in a businesslike manner.

The difficulties in the way of storing the wood-ashes are that they take a long time to cool, as they cannot be quenched by water, and that in order to take advantage of the cheapest form of railage the ashes must be stored until there is enough to fill a truck holding 6 tons, this meaning that the storage capacity of the shed must be at least so much. In the case under consideration, to obtain a single ton at Wellington from the mills would cost £1 19s. for freight, but a truck-load of 4 to 6 tons could be obtained at a rate of 15s. 8d. per ton. An attempt to have ashes classed as "E," which includes phosphates, and which would enable wood-ashes to be carried at 17s. 4d. per ton for small quantities, was unsuccessful. The output of ashes is liable to be overestimated by millowners owing to the light nature of the ash. Thus one firm wrote that they estimated they could supply from ½ ton to 1 ton per week, but their subsequent actual experience was that 1 ton a month was all that could be saved.

The composition of those sawmill ashes in bulk averages about 5 per cent. water-soluble potash (K_2O), or a total soluble in hydrochloric acid of 10 per cent. This is no doubt due to the combination of the silica in the ash with some of the potash. It is a matter for field experiment to determine what value should be assigned to the potash insoluble in water which these wood-ashes contain, but in the meantime one can only rely on the water-soluble potash, lime (about 30 per cent. CaO), and phosphate (1 to 5 per cent. P_2O_5) which they contain.

The writer hopes as occasion permits to visit the sawmills in various parts of the country and endeavour to induce the management to engage in saving the ashes.

Potash from Seaweed.—As the manufacture of potash from kelp or seaweed in New Zealand appeared to offer less prospect of success than other sources it was decided to investigate these latter first. No opportunity has occurred of collecting seaweeds for analysis from situations where they exist in sufficient quantity to offer reasonable prospects of making economic use of them. Such samples as have been analysed have shown a percentage of potash (up to 5 per cent.) in the ash, which does not compare with the figures (up to 40 per cent.) obtained on the American coasts. A very observant authority on the New Zealand seaweeds is of opinion that in no part of New Zealand is there sufficient seaweed to warrant the extraction of the potash. No information has been received of any locality where large quantities of seaweed could be obtained, although specially asked for in the *Journal* (20/12/16, p. 452). A locality would have to be found where seaweed could be continuously obtained in very large

quantities before it would be reasonable even to investigate the percentage of potash which it contains.

Potash from Sea-water.—The projected establishment in New Zealand of an evaporation-works for extracting sea-salt (by means of solar heat and wind) from sea-water has seemed a possible source of potash, as sea-water contains about 0·7 per thousand of potassium chloride, and this would largely be found in the mother liquors from which the less soluble salts, calcium sulphate and sodium chloride, had been removed. The establishment of this industry would not appear to have reached a stage at which anything further may be said as to the possibility of a potassic by-product.

Potash from Wool.—Six million pounds of wool were used locally at the woollen-mills in the year 1914–15, and if the potash had been recovered from the washing-water over 100 tons of potash would have been saved. In 1915 approximately 200,000,000 lb. of wool was exported from New Zealand, and, assuming that 75 per cent. was greasy and contained 5 per cent. of potassium carbonate, there would be 3,000 tons of potash salts exported with the wool. As for the same year we imported 3,000 tons of potash salts from Germany, it would seem that if the wool were washed and the washed-out constituents saved previous to export we should not only save the potash for internal consumption, but also save the wool-grease, lanoline and wool-wax, and, in addition, the shipping freight of so much wool-impurity sent over the seas. The saving of wool-fat, wool-wax, and potash from washing plants is fully described in the South Australian Department of Chemistry Bulletin No. 2 (Government Printer, Adelaide, 1916), which is fully abstracted in the *New Zealand Journal of Science and Technology*, No. 2, 1918 (Government Printer, Wellington).

Potash from Bracken-fern. — Since the last article (June, 1917, *Journal*) some additional analyses of bracken have been made, and the following results obtained :—

Laboratory No.	Loss at 100° C.	Ash.	K_2O on Dry Matter.	K_2O on Ash.	P_2O_5 on Ash.
J/383	64·20	6·90	0·29	4·30	..
384	84·20	6·40	3·09	48·30	..
475	74·00	5·80	2·80	48·30	8·10

J/383 is a sample of old fern, and J/384 is a sample of young shoots, both from Waikanae sandhills, collected October, 1917. J/475 is a sample from greywacke soil at Hayward's, collected December, 1917.

These results show the importance of utilizing the young or fairly mature shoots of braken in preference to the old fronds which are of the previous season's growth.

Potash from Flue-dusts.—This laboratory is actively prosecuting the investigation of flue-dusts from various factories, cement-works, &c., in New Zealand. If any manufacturer who turns out a large quantity of dust will send in a fair sample for analysis it will be investigated. One firm intimated that it turns out 5 to 10 tons per week of cement flue-dust, which on examination was found to contain 6 per cent. of potash. Another flue-dust (No. G/711) from a timber-mill was found to contain 13·51 per cent. of potash, water-soluble, and this at 15s. per unit (1 per cent.) would be worth at least £10 per ton to those requiring potash. Another sample (G/624) was evidently from a flue in the furnace of a timber-mill, and contained 13·69 per cent. of water-soluble potash.

Potash from Miscellaneous Waste.—A sample of ash apparently from refuse from Trentham Camp was found to contain 16·7 per cent. of phosphoric acid (P_2O_5) and 9·1 per cent. of water-soluble potash (K_2O). No information was received as to what the material was derived from or what amount was available, but the ash is obviously a very valuable fertilizer. Flax (phormium) mill refuse could no doubt be utilized to yield its potash if the matter were taken systematically in hand. When burnt the ash contains 21·51 per cent. of potash soluble in water, and would be worth at least £16 per ton. Of native-wood ashes the wood of the makomako (*Aristotelia racemosa*) has yielded the astonishing result of 15·18 per cent. potash. The sample (G/737) came from the Catlin's River district, where this tree has been used to produce charcoal for making gunpowder.

CONCLUSIONS.

From the foregoing it would seem reasonable to expect that if effort is made in the right direction the shortage of potash in the Dominion may be to a large extent met by utilizing waste products.

Care must be exercised in endeavouring to follow in the steps of other countries, where conditions are different, in ways of obtaining potash. The manufacture of potash from seaweed in New Zealand, for instance, though possible in America, offers very little prospect of success in New Zealand. A land-weed—bracken—is certainly a much more hopeful source.

In the utilization of wood-ashes, in which the potash exists as carbonate and silicate of potash, more field experiments are necessary before apportioning the exact value of (*a*) the carbonate, (*b*) the silicate soluble in hydrochloric acid, and (*c*) the carbonate of lime contained in the ash. These experiments might be planned to give definite answers as to whether New Zealand agriculture was in danger of being injuriously affected by the shortage of potash during the war, whether the application of potash fertilizers at the price now

charged is likely to prove an economic proceeding, either by the net increase due to potash or by the immunity to disease and insect pests conferred by potash, and whether such indirect substitutes as sodium salts may be relied upon to produce the same effect as potash during the few years in which it may be impossible to import potash.

The offer of a bonus for the first considerable quantity of potash fertilizers sold from New Zealand sources might go far to stimulate the production of potash from local sources. By classifying wood-ashes (bagged) as a potash fertilizer the railage would be considerably reduced. Engineering advice as to the proper type of sawdust and wood-waste destructors might be obtained from America and published. The alunite deposits of New Zealand might be investigated, and the price of potash might be fixed and the export of potash salts prohibited.

THE GRASS-LANDS OF NEW ZEALAND.

(Continued.)

A. H. COCKAYNE, Biologist.

CLASSIFICATION.

It would at first sight appear to be quite simple to define pastures. If we consider pasture as any crop that is grazed upon *in situ*, then many such as root crops and forage crops would be included. Certain crops, such as soft turnips, are grazed on under certain conditions, and are soiled under others. Then, again, hay would not come under the category of a pasture crop. For my part, I prefer to divide all crops that are used for the feeding of live-stock into two classes—grass-land crops and grass-land supplementary crops.

Under this definition grass-land consists of those portions of a farm the vegetation of which is in general formed principally of plants belonging to the natural order of Gramineae and Leguminosae, which may be used for the grazing of stock at any season of the year, and which persist for a period of not less than one year. All other crops used for the feeding of live-stock, irrespective of whether they may be grazed *in situ* or not, are termed grass-land supplementary crops. The only crop which by this definition wrongfully falls under grass-land is lucerne; but there is really an element of doubt whether one should consider a lucerne-field as grass-land or not. Again, in many

cases plants regularly used for grass supplementary crops are also used in the formation of grass-land, and during certain stages of its development it is at times difficult from a theoretical standpoint to discriminate as to class. For instance, grass and rape, grass and green oats, and many others, are, during the early stages, typical supplementary crops, but later become true grass-land.

The classification of grass-land is thus difficult, but is best done on the length of time it remains in pasture before being broken up, or, in other words, on its duration. From this point of view grass-land falls into the following groups: (1) Temporary grass-land; (2) short-rotation grass-land; (3) long-rotation grass-land; (4) permanent grass-land.

In addition to these, a special group has to be made for those long-rotation or permanent types of grass-land which act as grass supplementary crops. There are only two in New Zealand—namely, special paspalum pastures and special prairie-grass pastures.

Irrespective of duration, any grass-land may carry stock only during certain times of the year, and act as seasonal pasture, but this is a character depending entirely on climate and soil factors beyond any regulation of the farmer. Good examples are sandhill pastures used only in the winter and spring, and many types of swamp pastures too wet during the winter for grazing purposes.

Temporary and rotation pastures are nearly always laid down on ploughed land, and the same is true of permanent pastures when laid down on land easy of cultivation. Much permanent pasture is, however, established by surface-sowing after some type of a seed-bed has been produced by methods other than ploughing or cultivating. The term "permanent grass-land" is in reality rather a misnomer, as when on land capable of ploughing it may at any time be broken up. The term, however, can be applied to any type of grass-land that is laid down without any fixed intention of using it for annual cropping purposes.

Most temporary and all rotation pasture in New Zealand is established on land that some time previously consisted of sown grass-land. So far as sown permanent pastures are concerned, some are on land previously carrying sown grasses, but the vast majority are on land where the original vegetation was more or less natural. In the North Island many of them, from their mode of preparation previous to sowing, are termed "bush-burn pastures," or "bush-burn grass-lands." Then, again, there is a very large area of natural grass-land, mainly in the South Island, which is included under permanent grasses. Some of this is in its primitive condition, but much has been modified by stocking and other means.

The following is a very rough and incomplete classification of our main grass-lands :—

A. Grass-land on Ploughed Ground.

(1.) Temporary.
- (*a.*) Italian rye-grass, clovers.
- (*b.*) Western Wolths rye-grass, clovers.
- (*c.*) Clovers.

(2.) Short-rotation.
- (*a.*) Perennial rye-grass, clovers.
- (*b.*) Perennial rye-grass, cocksfoot, clovers.
- (*c.*) Perennial rye-grass, cocksfoot, timothy, crested dogs-tail, clovers.

(3.) Long-rotation.
- (*a.*) Perennial rye-grass, clovers.
- (*b.*) Perennial rye-grass, cocksfoot, clovers.
- (*c.*) Cocksfoot, perennial rye-grass, mixed grasses, clovers.
- (*d.*) Paspalum special pasture.
- (*e.*) Prairie-grass special pasture.

(4.) Permanent.
- (*a.*) Rye-grass.
- (*b.*) Rye-grass, cocksfoot.
- (*c.*) Meadow-foxtail, rye-grass, timothy.
- (*d.*) Chewings fescue.
- (*e.*) Paspalum, cocksfoot.
- (*f.*) Swamp pastures leading from Italian rye-grass to permanent pasture.
- (*g.*) Drained swamp directly sown in permanent pasture.

B. Grass-land on Unploughed Ground.

(1.) Bush-burn, fern-land, and scrub-land.
- (*a.*) Rye-grass—cocksfoot type.
- (*b.*) Cocksfoot—rye-grass type.
- (*c.*) Cocksfoot—Chewings fescue or danthonia or fiorin, &c., type.
- (*d.*) Derivatives from types 1, 2, and 3 on which succession has occurred.

(2.) Swamp-land.
- (*a.*) True swamp type: Meadow-foxtail, or cocksfoot—timothy—rye-grass type, and the series leading to them.
- (*b.*) Peat bogs: Yorkshire-fog and its successions.

C. Natural Grass-land.

(1.) Sub-alpine fell-field.
(2.) Montane tussock and its successions.
(3.) Lowland tussock and its successions.

TEMPORARY GRASS-LAND.

Temporary grass-land consists of pasture that does not last longer than two years and is then broken up. It may then either be cropped with a rotation of annual crops and again be put back into some type of grass-land, or it may be broken up and seeded with a more permanent

mixture. In certain cases the permanent mixture may be harrowed in without ploughing during the first or second year.

Temporary pastures have the great advantage that their yield is considerably higher than long-rotation or permanent grass-land on the same soil. It is safe to assume that a temporary pasture on 12-ton grass-land soil would yield in two years 36 tons of green feed. This, on the 4s.-per-ton basis, means that on such ground there will be a difference of £2 8s. per acre in favour of temporary pasture during the two years, or more than sufficient for the extra expense of production. It would thus appear as if temporary pasture could compete successfully against ordinary good established grass-land under all conditions, but such is not the case. It is highly doubtful whether temporary pasture can compete against the very finest grass-land; in other words, it is doubtful whether the maximum yield of temporary pasture ever exceeds 30 tons per annum, and if such is the case there is no margin for the extra cost of production of temporary pasture. Again, in considering this matter it is important to note that on grass-land of low yielding-capacity temporary pasture has to show a very much greater proportionate increase in production than over better-class grass-land. In fact, temporary pasture must show an actual increase of at least 12 tons in two years at 4s. above the yield of grass-land against which it competes (£2 8s. being roughly the increased cost of production as against permanent grass). With short- and long-rotation grass-land the difference in cost is not so great, and a smaller extra yield than 6 tons per year will compete successfully. On permanent grass-land that requires top-dressing annually not more than 4 tons to 5 tons annual increase is necessary.

Thus, for instance, to compete against 4-ton grass-land 10 tons is necessary, or 150 per cent. increase. On 12-ton grass-land the increase necessary is only 50 per cent., and on 28-ton land about 22 per cent. increase would be sufficient to justify temporary-pasture establishment. It will therefore be seen that the types of grass-land which are most difficult for temporary pasture to compete with under all conditions are low-yielding and very high-yielding permanent grass-land. In competition with 12-ton to 20-ton grass-land temporary pasture should often prove successful.

Temporary pasture has, however, three great advantages, even when from the cost-of-production standpoint it cannot compete against established grass-land.

(1.) It can be utilized in a variety of ways to supplement established grass-land during crucial periods.

(2.) It can be used more conveniently and cheaply than a more permanent type of pasture to rest and improve (provided plenty of clovers are used) grass supplementary land where this is available only in small areas on a farm.

(3.) It can be used in the breaking-in of certain classes of country before a more permanent type of grass-land is established. If it is necessary to break it up and adopt a further system of cultivation before finally grassing permanently, it costs less and yields more than if permanent pasture were laid down and had to be broken up again.

The following are the main uses to which temporary pasture can be put as a grass supplementary crop: (1) To afford additional winter and early spring feed; (2) for haying, giving a larger yield than from ordinary grass-land; (3) for summer soiling; (4) to afford special feed for flushing ewes.

It is thus seen that temporary pasture can replace to a certain extent special winter and summer forage, often at a cheaper rate, owing to its ability to be continuously used during some other parts of the year without any additional expense. When a successful competitor against more permanent grass-land, it can be profitably grazed throughout the year. Otherwise, in order to justify its establishment, it must be used partly for some special purpose when other feed is short. Wherever the cost of production per grass-ton is less than that of any other type of grass-land, then the whole of the grass-land of a farm should be of a temporary character. This, however, is not usual, although there is no doubt that on much high-class land subject to summer drought temporary grass-land would pay well, provided the land is suitable for good clover-development.

In estimating the economic position of temporary pasture the length of time it is down is of very great importance. Thus, if laid down for any period less than two years the yield would have to be increased in order to make it payable, or else it should have to fulfil some very special purpose for which ordinary grass-land is not available.

In the South Island temporary pastures are generally cut for seed (Italian rye-grass) instead of any hay crop being harvested, the rye-grass straw being fed in combination with roots in winter. For breaking in ploughable fern country temporary grass-land is often laid down and a certain amount of annual cropping carried out before a more permanent type of grass-land is established. On ploughable land badly infested with blackberry temporary pasture should always precede any grassing of a permanent nature.

Temporary grass-land can follow any type of crop, as it may be either spring- or autumn-sown. For my part, I consider that autumn sowing is far preferable. The following can be looked upon as the standard mixture: Italian rye-grass, 20 lb. to 24 lb.; red clover, 4 lb. to 6 lb.; sometimes Western Wolths is used instead of Italian, and alsike is often included. If intended for a full two years, or perhaps a little more, a few pounds of cocksfoot may be added, provided the cost is not too great.

The following are some types of rotation in which temporary grass-land can play a very useful part :—

(1.) Roots ; summer forage ; temporary pasture, autumn-sown ; roots, &c. In this case the pasture has to be broken up either in late winter or early spring.

(2.) Roots ; summer forage ; winter forage (oats) ; temporary pasture, late spring-sown, with rape.

(3.) Roots ; rape and temporary pasture ; roots, &c.

(4.) Roots ; summer forage ; temporary pasture, autumn sown ; oats for green feed or hay ; summer forage ; temporary pasture ; roots, &c.

Without doubt the most useful dairying rotation is roots ; summer forage (soft turnips and maize) ; temporary pasture ; roots, &c. If extra winter supplementary feed is essential, then roots ; summer forage ; temporary pasture ; winter oats ; and roots, should be adopted.

Autumn-sown temporary pasture can be utilized as follows : First winter, grazed ; first spring, grazed ; first early summer, hayed ; first late summer, either grazed, hayed, or soiled. If hayed, delay cutting till a fair amount of Italian seed is ripe (the hay will be mainly red clover). Second winter, grazed ; second spring, grazed ; second summer, hayed twice, or hayed and soiled, or hayed and grazed ; or second spring, broken up either for roots or summer forage. If broken up in the autumn a cereal can follow.

Closely approaching temporary grass-land is the seeding of a cereal crop with from 6 lb. to 9 lb. of red clover. Its disadvantage compared with temporary Italian pasture is the poor winter and spring yield.

There is no doubt that temporary pastures will become more and more popular in dairying districts, but their actual net earning-power in comparison with more permanent pastures should always be determined before they are made a regular feature on any farm. An important feature of temporary grass-land in dairying districts is the two-year or longer period that can be secured between the sowing of turnips, which may probably be sufficient to keep down club-root. If club-root is very bad, however, soft-turnip growing would have to be abandoned.

SHORT-ROTATION GRASS-LAND.

Short-rotation grass-land is important in New Zealand, not less than 500,000 acres being laid down annually. The duration varies from three to five years, but generally by the end of the third season an undesirable succession has taken place, necessitating ploughing up. It is on these short-rotation pastures that most of the

perennial rye-grass is used, and they are all of a rye-grass type. Short-rotation pasture is found chiefly in the cereal-growing districts of the South Island. In the drier parts from 25 lb. to 30 lb. of seed, including a bushel of rye-grass, is sown, and in the wetter parts from 40 lb. to 50 lb. of seed is used, including about a bushel and a half of rye-grass. The following are some typical mixtures :—

	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Perennial rye-grass ..	20	20	20	30	30	30	40
Italian rye-grass	..	..	4	..	5	..	..
Cocksfoot	..	3	3	6	4	6	4
Timothy	..	..	..	2	2	2	2
Crested dogstail	..	..	..	1	..	1	..
Red clover	4	4	3	4	4	4	4
White clover	1	1	1	1	1	..	1
Alsike	..	..	..	..	2	2	..

White clover is often omitted, as it is said to come up naturally. In Canterbury very little except perennial rye-grass, cocksfoot, and red clover is ever sown, but in Otago and Southland more elaborate mixtures are often used. Italian rye-grass is popular only in certain districts, and is often used only in temporary grass-land. There is a widespread opinion that the presence of Italian causes undesirable successions to appear sooner than when it is not used.

One of the great faults of the short-rotation pastures of the South Island is that they cannot be left down and function as long-rotation ones. In most cases a succession takes place after the third year, and poor grass-land results. The commonest types of succession are,—

Rye-grass to goose-grass—hair-grass to *Poa pratensis*—yarrow.
Rye-grass to goose-grass—hair-grass to Yorkshire fog—agrostis.
Rye-grass to goose-grass—hair-grass to sweet vernal—danthonia.
Rye-grass to goose-grass—hair-grass to catsear, sorrel—sweet vernal, &c.

One of the most pressing problems of grass-land study in the South Island is the successful grassing with a profitable type of long-rotation mixture in which successions such as the foregoing would not occur.

The greater part of short-rotation grass-land is spring-sown either with rape or oats. The fact that the pastures soon become worn out has rendered both a cheap type of seed and a cheap establishment necessary. For the same reason top-dressing is not popular, and the opinion that it makes no difference is regularly expressed. Sowing with rape is most popular in the southern districts, but in parts of Canterbury seeding with a cereal crop is still largely carried out. Short-rotation grass-land is nearly always of low carrying-capacity when once the rye-grass begins to flower, and extensive use of summer supplementary crops is a conspicuous feature over the area where such grass-land is the regular type. The winter carrying-capacity of short-rotation pasture is also often poor in the South Island, but this is due to climatic conditions, and can never be avoided. In very dry districts

short-rotation grass-lands often fail completely in the second summer, but even in comparatively wet districts their midsummer yield of palatable herbage is poor. A considerable amount of short-rotation grass-land is cut in its first and second season for rye-grass seed.

As indicated, the short-rotation grass-land of the South Island is really of low carrying-capacity, and it is more than doubtful if it averages more than 1¼ stock-units per acre. The exact figures, however, are difficult to determine. Improvement in lasting-quality seems to be connected with an increase in cocksfoot, as has been partly shown in the Lincoln College experiments. One of the great difficulties in the drier parts is the unsatisfactory germination of cocksfoot, except when autumn-sown.

In the drier districts rotation mixtures sown with cereals regularly fail, and the resultant pasture is, from the start, of a poor successional character. When a wet spring follows a dry summer that has caused the rotation mixture to fail a great growth of white clover develops. In fact, it is on unsown stubble that white-clover seed is often harvested in the following summer, but conditions have of course to be very favourable, otherwise sorrel is often dominant.

LONG-ROTATION GRASS-LAND.

Long-rotation grass-land is not common in New Zealand. In general, leas of longer duration than four to five years are laid down without any thought of the land being used for rotation purposes. If at the end of a certain number of years the pasture becomes worn out, then annual cultivation may be carried out, or the pasture may be revivified by top-dressing with artificial manures. However, any of the permanent or semi-permanent types of pasture on easy ploughable land may be used as long-rotation grass-land, just as occasion demands. On good ploughable land where rye-grass holds well long-rotation grass-lands composed very largely of perennial rye are common. After from five to eight years the grass-land is renewed by sowing down rape in which a grass-mixture is included. Such practice is a common one in the rye-grass districts of Hawke's Bay and the west coast of the North Island, and the grass-land is generally cut for seed during the early years of its duration.

There are, again, very large areas where the ordinary type of rye-grass–cocksfoot seedings become invaded with inferior grasses—such as fog, fiorin, sweet vernal, and danthonia, also catsear—very much more slowly than they do in the short-rotation grass-land areas of New Zealand. In such districts the pasture is left down until foreign growths are getting the upper hand, and again sown with a long-rotation mixture. In what are not truly rye-grass districts these mixtures often differ from short-rotation mixtures by an increase in

the amount of cocksfoot that is used. Expensive seeds, such as foxtail, meadow-fescue, and *Poa trivialis*—absent entirely from short-rotation mixtures—are often used. So far as the economics of long-rotation grass-land are concerned, it is a question whether they should be adopted or made of a permanent character by careful and regular top-dressing.

PERMANENT GRASS-LAND (PLOUGHED GROUND).

Permanent pasture is generally the type aimed at on heavy soils of rather a moist character, and on good swamp soils that have been drained and rendered suitable for cultivation. In places perennial rye-grass is the main grass used, as, for example, on the land around Hastings and on the river-bottoms of many of the North Island east-coast rivers. Permanent pasture, however, generally consists largely of cocksfoot, and on especially favoured soils meadow-foxtail may be the chief grass used. High-class permanent pasture on ploughed land often becomes invaded with serious weeds or succession growth. In general, the most serious succession development that takes place is to rushes, but proper attention to drainage should generally act as an efficient control in this respect. In fact, in nearly every case the weed that becomes dominant is one that does not tolerate well-drained conditions. Buttercups, self-heal, certain docks, and pennyroyal are good examples of this.

Permanent pastures on ploughed land are nearly always used for dairying, and may often be cut for hay. The weakness of much of our permanent pasture of this type is its paucity of clovers, a defect that does not seem to be remedied by an increase in the clover-content of the seeding.

(To be continued.)

Grasses for Tidal Land.—Referring to the answer given to a correspondent in the March *Journal* with regard to land at Clive subject to partial tide-flooding, a correspondent has forwarded a specimen of a grass which grows round the shores of Ohiwa Harbour, North Auckland. He says that it was introduced from France or Belgium by the late Major Frank Chapman, and, although not of any great feeding-value, the grass is useful as a pioneer on tidal lands. The specimen has been identified by the Biologist as seashore twitch (*Agropyron junceum*, often known as *Triticum junceum*). It is considered that the grass would be useful in reclaiming very sandy tidal land; in Europe it is common on sands partially liable to inundation at the mouths of slow-flowing rivers. It is, however, not very palatable to stock, and its near relative, the ordinary twitch (*Agropyron repens*) should be better in this respect.

GRADING OF FRUIT-TREES.

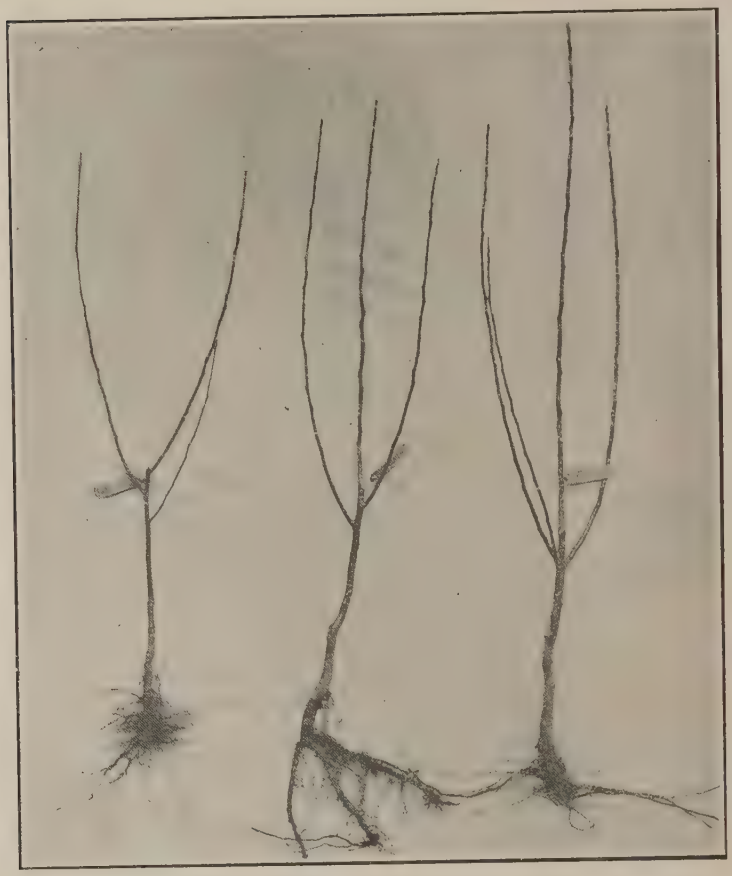
STANDARDS ADOPTED.

T. W. KIRK, Director, Horticulture Division.

JUST prior to the outbreak of war a Horticultural Industries Bill was prepared. By this means it was proposed to amend and considerably extend the scope of the Orchard and Garden Diseases Act, 1908, so as to deal in a comprehensive manner with all phases of horticultural industry. The bursting of the war-clouds resulted in the postponement of this and many other important legislative measures. A brief amending Act, dealing with several pressing matters and others likely in the then near future to demand attention, was passed, however, and is known as the Orchard and Garden Diseases Amendment Act, 1914. The grading of fruit-trees was provided for in the following clause :—

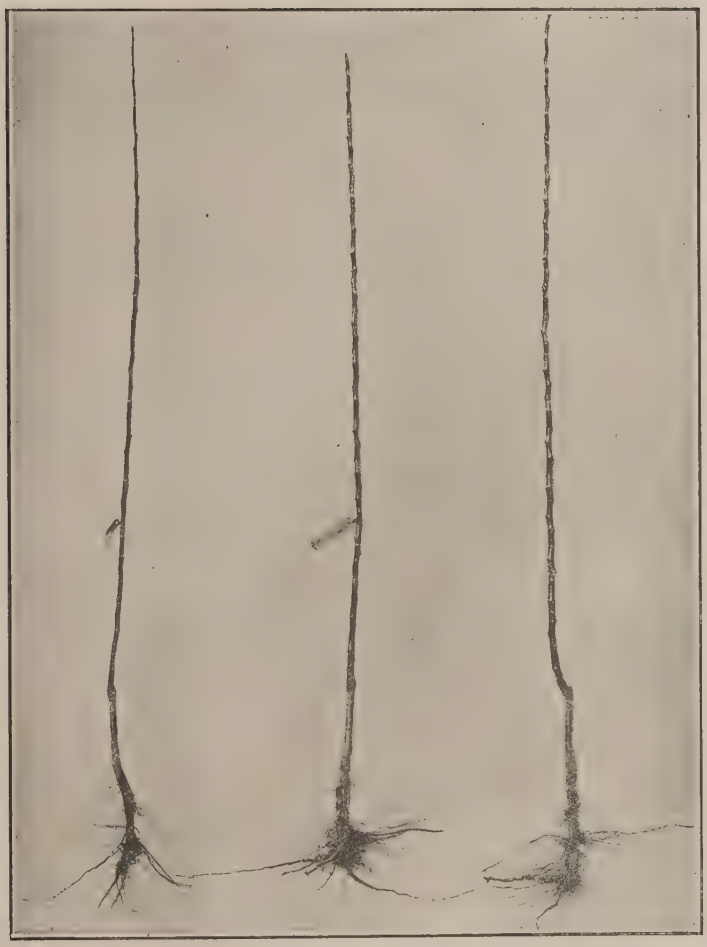
> In addition to the powers conferred by the said section [section 20 of the principal Act] the Governor may from time to time, by Order in Council gazetted, make regulations—
>
> (*a.*) Providing for the grading of fruit-trees and other trees intended for sale from nurseries, and prescribing conditions in respect of the sale of such trees.

It was felt that the time had arrived when a beginning should be made to place the fruit-tree trade on an improved footing. The nurserymen themselves fully recognized this and took the initiative. The question was under consideration in 1916, but presented many difficulties. These, however, have been gradually overcome, with the result that at the conference of the New Zealand Association of Nurserymen held in Christchurch in January last a committee was set up, on which the Department was represented by Mr. J. A. Campbell, Assistant Director of the Horticulture Division. This committee was empowered to devise a scheme of grading—the same to be binding on the nurserymen ; further, that the Department be asked to issue regulations embodying the results of the committee's work.



GRADED APPLE-TREES (BRANCHED).

Showing (from left to right) minimum, intermediate, and maximum standard samples in the commercial grade.



GRADED APPLE-TREES (RODS).

Commercial grade standard samples—minimum (left) to maximum (right).

The committee met in the middle of April, and subsequently handed me the following report covering both grading and prices :—

After considerable discussion and the examination of various varieties of saleable fruit-trees the following resolutions were unanimously carried :—

APPLES AND PEARS.

All grades of trees shall be well rooted, and, when branched, of fair shape. Branched trees to have not less than three branches averaging 18 in. in length. Diameter of tree to govern. All caliper measurements to be taken 2 in. above the union. All grading to be irrespective of age.

Grades.

A. Commercial grade : Diameter measurements to be — minimum, $\frac{7}{16}$ in. ; maximum, $\frac{10}{16}$ in.

B. Nursery grade : To be all trees under the minimum fixed for commercial grade (*i.e.*, $\frac{7}{16}$ in. diameter).

C. Special grade : To be all trees above the maximum of the commercial grade (*i.e.*, $\frac{10}{16}$ in. diameter).

APRICOTS, PEACHES, AND NECTARINES.

All trees to be well rooted, branched, and of fair shape. Diameter measurements to be taken 2 in. above the union, and to be not less than $\frac{8}{16}$ in.

MARGIN OF ERROR FOR ALL TREES.

In no instance will more than 5 per cent. of error in grading be allowed, and any such errors are not to be more than $\frac{1}{16}$ in.

PRICES.

A. Commercial grade : £45 per thousand ; £5 per hundred ; 18s. per dozen. (The same as in the past, and as agreed with the New Zealand Fruitgrowers' Federation, Ltd., except that the grading will eliminate the smaller trees.)

B. Nursery grade : £40 per thousand ; £4 per hundred ; 15s. per dozen.

C. Special grade : The large trees to be at a proportionately higher rate, as at present.

We, the undersigned members of the Committee, certify that the foregoing report of the decisions is correct.—Thomas Waugh ; Thomas Horton ; Edward Ivory, jun. ; George A. Green ; J. A. Campbell.

This is a step in the right direction, and the decisions — which shortly will be embodied in regulations — are, I think it will be admitted, in the interests of growers and nurserymen alike. Before extending the scheme to all classes of fruit-trees it is considered advisable to gain a season's experience with the more prominent lines only.

The accompanying photographs afford a good idea of the maximum and minimum allowed for both rods and branched trees in the commercial grade.

AMERICAN AGRICULTURAL TRACTORS.

[The following statement is by a New Zealand agricultural-machinery expert who, on behalf of the Government, by arrangement with this Department, has investigated the tractor position in the United States.]

THE agricultural tractor, to the writer's knowledge, has been manufactured in the United States for seventeen years past, but it is only quite recently, and possibly owing to the world war, that this industry has jumped into prominence. More progress has been made during the last three years than in the previous fourteen. Although there are now on the market what might be called a number of freak machines, it will not be long before these are eliminated and a standard set for the best type of tractor that will suit general conditions.

During a visit to the United States at the beginning of last year I took the opportunity of investigating the tractor proposition, and had practically completed this work when I was requested by the New Zealand Government to carry out investigations on their behalf. At that time I had already come to the conclusion that what we wanted in New Zealand was a light tractor weighing not more than 5,000 lb., with a draw-bar pull of 2,000 lb. to 2,500 lb. at ploughing-speed, four-cylinder motor, kerosene-burner, strong road wheels, direct belt-drive, gears enclosed, spring-mounted or separate wheels for road work, and two-speed, one for cultivating and one for road work. Although I did not find what, in my estimation, was the ideal machine for this country, there are a number of tractors made in the United States to-day that would give very good satisfaction on New Zealand farms.

There are a great variety of types, but for my purpose it will be quite sufficient to deal with four only. They are—(1) the caterpillar or tracklayer; (2) two-wheel tractors with trailer wheel; (3) three-wheel tractors; (4) four-wheel tractors.

Very early in my investigations I eliminated the first three, though each type has certain advantages. For general purposes, however, I consider the four-wheel tractor the best. In time to come manufacturers may overcome some of the weak points in the other types, but at present I do not feel justified in recommending them for general work in New Zealand. The notes which follow on types 1, 2, and 3 may, however, be of interest.

THE CATERPILLAR OR TRACKLAYER.

This type derives its name from the fact that it carries its own track, and lays it as the machine progresses. I do not think there is any question that these tractors will show a greater draw-bar pull per horse-power and weight than any other type (with the possible exception of the all-driver four-wheel). On the other hand, there are so many moving parts exposed that wear-and-tear is excessive and renewals costly. For road work the caterpillar is not so suitable as a wheel tractor; in fact, in some counties in New Zealand it is questionable if they would be permitted on the road. They are, however, particularly well adapted for field work, and in loose sand or swampy ground where conditions are very bad. They are also good on hillsides, as they are not so inclined to side-slip as the round-wheel tractor. Caterpillar machines are used very extensively in California, where great power is required for drawing special subsoiling-machines. I have heard of three caterpillar tractors (two of 75 h.p. and one of 60 h.p.) being yoked to one subsoiler, and in this particular class of work it is questionable whether a round-wheel machine would give as good service as the caterpillar.

TWO-WHEEL TRACTORS.

Most of these have a truck or trailer wheel to steady the machine when on the road or travelling over fields. Some of them are operated by a pair of reins, in the same way as a horse is driven, and they are just as sensitive to the reins as a well-broken horse. But I do not think the type will ever be looked upon as a standard or generally used, any advantages they may have being offset by numerous disadvantages. One point in their favour is that they can be hitched to an ordinary farm implement without making any changes in the latter. The operator can walk behind or ride his plough, cultivator, disk harrow, drill, or binder, just in the same way as if the machine was drawn by horses.

THREE-WHEEL TRACTORS.

Some of these are doing exceptionally good work, but, taking everything into consideration, I do not recommend them for general working-conditions in New Zealand, where road as well as field work will undoubtedly be undertaken by tractors in the future. I would, however, like to mention two three-wheel tractors that came under my notice. They are the Wallis Cub Junior and the Samson or Sieve Grip, manufactured by the J. I. Case Plow Company, of Racine, Wisconsin, and the Samson Sieve Grip Tractor Company, Stockton, California, respectively. Since leaving the States, I understand, the General Motors Company have taken over the Samson

tractor, and intend manufacturing it in the East. I prefer the Wallis Cub, for the reason that the whole of the gears are enclosed and running in a bath of oil; it is impossible for dust or dirt to come in contact with one single gear. It is also a comparatively simple matter to attach special road wheels for road work, or open-tread wheels for field work. The only advantage the Samson has over the Wallis Cub is the Sieve Grip wheels. On some land these do exceptionally well. On the other hand, the Samson has exposed gears, and generally, in my opinion, is not such good construction as the Cub.

FOUR-WHEEL TRACTORS.

I will divide these into three classes: (1) Low-priced tractors; (2) high-priced tractors; (3) four-wheel-drive tractors.

In reference to the low-priced tractor, there is one which, although in design and workmanship not to be compared with more expensive tractors, may suit many farms in New Zealand where field work only is required, and where price is a major consideration. I refer to the Waterloo Boy, manufactured by the Waterloo Gasoline Engine Company, of Waterloo, Iowa. This tractor, in my opinion, is not very suitable for road work; the single-speed machine will only do up to two miles and a half per hour, while the two-speed, on high gear, will only do three miles per hour.

With regard to the high-priced tractors, there are two that impressed me very much indeed. They were,—

(1.) The Parrett, made by the Parrett Manufacturing Company, of Chicago. It is well designed, with good heavy frame, large front wheels, substantial rear wheels, all gears (with the exception of final drive) enclosed and running in oil, and motor (four-cylinder Budda) set crosswise on frame. It has no bevel gears, can be operated ploughing with off-side wheels in furrow or on land, has foot-board low, draw-bar attachment from below axle, no gears running when driving by belt, all principal bearings fitted with S.K.F. ball bearings; speed, half to five miles per hour; 12–25 h.p.; draw-bar pull, 3,000 lb.; weight, 5,200 lb. It will burn kerosene, and will draw three 14 in. ploughs.

(2.) The Sandusky, 10–20 h.p., made by the Dauch Manufacturing Company, of Sandusky, Ohio. This is also a well-designed machine. All gears are enclosed and running in oil, final drive through worm gear, road wheels fair, and spring-mounted. It can plough on land or in furrow, one set of bevel gears running when driving by belt; speed, two to three miles per hour (too slow for road work); S.K.F. ball and Hyatt roller bearings used; will burn kerosene; weight, 4,600 lb.; draw-bar pull, 2,000 lb. It is recommended for two to three 14 in. ploughs, according to conditions.

OTHER TRACTORS.

One or two four-wheel-drive tractors were on the market, but I did not have an opportunity of investigating them. I think there are some possibilities in this type. They will certainly be more efficient than the ordinary four-wheel two-driver machine.

I had an exceptional opportunity of inspecting the tractor Mr. Henry Ford is working on, and was very favourably impressed with it. So far as one can judge of it in its present stage of development it will be a successful machine, and probably better suited for our conditions than any tractor I have seen. It is very compact and well designed. The motor is 28 brake horse-power, draw-bar pull 2,600 lb., worm drive, all gears completely enclosed in oil bath, ploughing speed two miles and a half per hour, road speed up to twelve miles per hour, burns kerosene successfully, and will plough 7 acres per day of ten hours. Special rubber-tired wheels can be fitted for high-speed road work. It will be manufactured by Henry Ford and Son, at Dearborn, Michigan, and is called the Fordson.

Addendum. — Since the above was written the present Fordson model has passed its final inspection, and is being manufactured in quantity for the British Government. In February of this year about three thousand of these tractors had been sent to England, and it was expected that the second three thousand would be shipped by the 15th March. Henry Ford and Son will then start work on an order of two thousand tractors for the Canadian Government. When I visited Henry Ford and Son's experimental plant at Dearborn it was only a small shop. Since then 195,000 square feet of floor-space have been added to the plant. On the 1st October last they were making about one tractor per day; in February of this year they were building 100 a day of twenty-four hours, and it was expected that by 1st April the production would reach 200 per day of twenty-four hours. Latest advices from the United States give one the impression that it will be quite twelve or eighteen months before Henry Ford and Son will be in a position to export tractors other than to Great Britain.

Lotus major Seed.—A 9-acre paddock shut up for hay at Ruakura during the past season showed so much *Lotus major* that it was decided to allow the seed of this plant to mature before cutting the crop. The result of threshing was 6 cwt. of first-grade seed (cleaned weight), which was sold at 4s. 6d. per pound, or a total of £151 4s.—the price being very high owing to the market shortage. In addition, there was estimated to be over a hundredweight of seed left in the cavings, which latter were top-dressed on a portion of the swamp area of the farm. After threshing, the hay was stacked, weighing 15 tons.

CONTROL OF BROWN-ROT.

PEACH-ORCHARD EXPERIMENTS AT HENDERSON.

J. W. COLLARD, Orchard Instructor, Auckland.

In view of the damage done by brown-rot (*Monilia fructigena*) in the northern districts during the 1916–17 season, the Horticulture Division recognized the probability of further trouble during the ensuing season, and the necessity for initiating a series of experiments as a means of determining a reliable combative or remedial treatment. In response to representations made by the Henderson Fruitgrowers' Association, and following offers made by that body in April of last year of several up-to-date commercial peach-orchards at Henderson for the purpose of carrying out experiments in the control of the disease, the Division decided to co-operate accordingly with the association and with individual local orchardists. Fourteen suitable peach-orchards were offered, and it was decided to accept the use of those of Messrs. F. G. Platt, T. Colebrook, and J. and W. Bodley. A series of comprehensive tests was drawn up and agreed upon by the orchardists, the experiments advisory committee, and the Division. The tests were divided into three groups, each to be carried out in a separate orchard.

The orchards selected for the tests were such that as many varieties as possible would come under the same test in the one block, having regard for the condition of the trees and general suitability. The tests were also so arranged that rows of trees which received the summer sprayings crossed those sprayed in the autumn and early spring, thus providing a maximum number of experiments.

The following is the scheme of work laid out :—

ORCHARD No. 1.—Owner: F. G. PLATT, Henderson.

Area selected covers eight rows of eighteen trees each.

Winter Treatment.

Destroy old leaves and fruit. Prune trees. Plough the land, &c.

Divide the area into four parts, A, B, C, D, each part to comprise two rows of eighteen trees each.

A. Spray with 8-6-40 bordeaux—May and August.

B. Spray with 8-6-40 bordeaux—August only.

C. Spray with 1–15 copper-sulphate solution—May and August.

D. Spray with 1–15 copper-sulphate solution—August only.

Summer Treatment.

Plough and work the land in the usual way. Thin fruit well. Gather and destroy all fallen and affected fruit at least once in each month.

Take twelve rows across the winter experiments and divide them into six parts, E, F, G, H, I, J, each to comprise two rows of eight trees each.

E. Spray after the fruit has set, again when the early fruits begin to ripen, and again about three weeks later, using 2-3-50 bordeaux.

F. Spray as for A, less the spraying after the fruit has set.

G, H. Spray as for E and F, using lime-sulphur 1–130 instead of bordeaux.

I, J. Spray as for E and F, using atomic sulphur 8–100 instead of bordeaux.

The remainder of the area, comprising six rows of eight trees each, to be left unsprayed during the summer.

A record to be kept of the number of affected fruits destroyed with respect to A, B, C, D, up to the first row that has been summer-sprayed. A record to be kept also of the number of affected fruits destroyed with respect to E, F, G, H, I, J.

Take two rows across the winter experiments of that portion left unsprayed in the summer, and spray the ground under the trees with sulphate of iron at the rate of 2 lb. per tree.

ORCHARD No. 2.—Owner: T. COLEBROOK, Henderson.

Area selected covers twelve rows of sixteen trees each.

Winter Treatment.

Destroy old leaves and fruit. Prune trees, &c.

Divide the area into four parts, A, B, C, D, each to comprise three rows of twelve trees each.

A. Spray with 8-6-40 bordeaux—May and August.

B. Spray with 8-6-40 bordeaux—August only.

C. Spray with 1-15 copper-sulphate solution—May and August.

D. Spray with 1–15 copper-sulphate solution—August only.

Summer Treatment.

Plough and work the land in the usual way. Thin fruit well. Gather and destroy all fallen and affected fruit at least once in each week.

Divide the area into three parts, E, F, G, across the winter experiments.

E. Spray with 2-3-50 bordeaux.

F. Spray with lime-sulphur, 1–130.

G. Spray with atomic sulphur, 8–100, as often as circumstances demand.

A record to be kept of the number of affected fruits destroyed with respect to E, F, and G.

B. Spray the ground under the trees with sulphate-of-iron solution at the rate of 1 lb. per tree.

ORCHARD No. 3.—Owners: J. and W. BODLEY, Henderson.

Area selected covers thirteen rows of ten trees each.

Winter Treatment.

Destroy old leaves and fruit. Prune trees, &c.

Divide the area into four parts—A, B, C, D. A and C to comprise three rows each with thirteen trees in each row; B and D to comprise two rows each with thirteen trees in each row.

A. Spray with 8-6-40 bordeaux—May and August.

B. Spray with 8-6-40 bordeaux—August only.

C. Spray with 1–15 copper-sulphate solution—May and August.

D. Spray with 1–15 copper-sulphate solution—August only.

Summer Treatment.

Plough and work the land in the usual way. Thin the fruit well. Gather and destroy all fallen and affected fruit at least once in each week: the latter to apply to half the area only, as explained later.

Number the rows from 1 to 13 across the winter experiments.

1. Spray after the fruit has set, again when the early fruits begin to ripen, and again about three weeks later.
2. Spray as for 1, less the spraying after the fruit has set.
3, 4. Spray as for 1 and 2, using lime-sulphur instead of bordeaux.
5, 6. Spray as for 1 and 2, using atomic sulphur, 8–100, instead of bordeaux.
7, 8. Spray as for 1 and 2.
9, 10. Spray as for 3 and 4.
11, 12, 13. Spray as for 5 and 6.

Do not destroy fallen and affected fruit with respect to rows 7 to 13. A record should, however, be kept of all affected fruit with respect to each row 1 to 13, whether the fruit is destroyed or not.

The accompanying diagrams of the experimental areas in orchards Nos. 1 and 2 will make the scheme clear.

The work in orchards Nos. 1 and 2 was duly carried out, but in No. 3, owing to the orchard changing ownership just at the time of commencing the summer sprayings, it was found necessary to abandon the area for the season. However, the scheme of winter and summer work to be carried out in this plot is included for general information.

In orchard No. 2 the matter of summer sprayings was left open, with the particular idea of endeavouring to minimize the number of applications.

As indicated above, the sprays used in autumn and early spring were bordeaux (8-6-40), copper-sulphate solution (1–15); and in summer bordeaux (2-3-50), lime-sulphur (1–130), and atomic sulphur (8–100).

In addition to these, soil-dressings were applied in the form of sulphate of iron, both in dry powdered form and in solution.

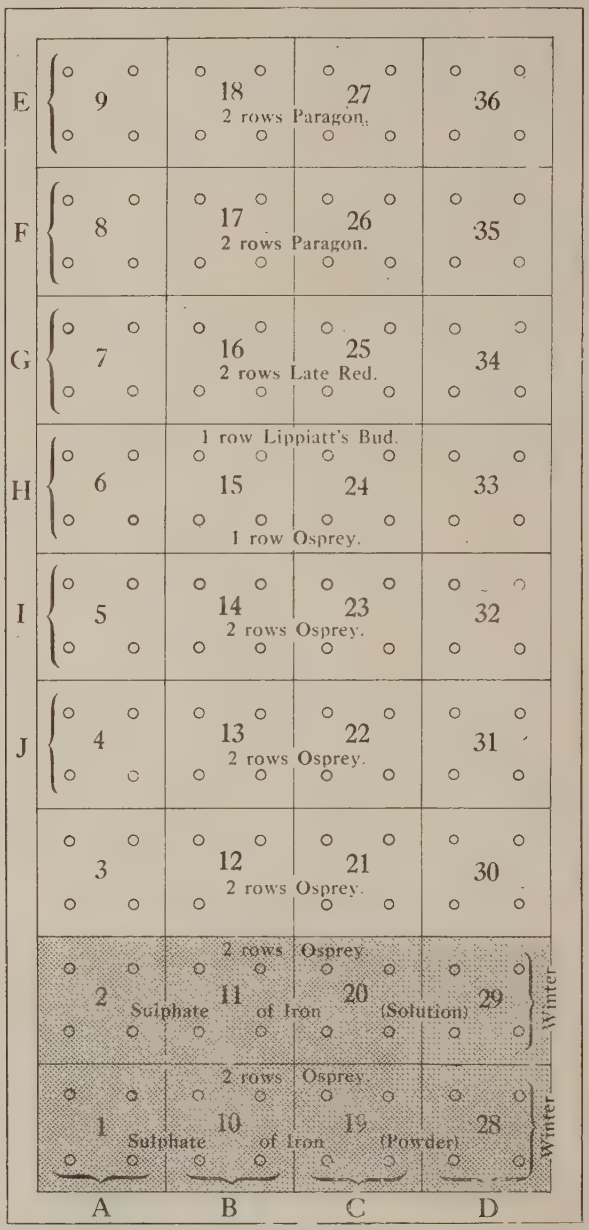
The main objects of the tests were as follows:—

With spring and summer cultivation: (1) To test winter sprays; (2) to test winter sprays in conjunction with summer sprays; (3) to minimize number of sprayings by elimination of summer treatment; (4) to test soil-treatment.

With autumn, spring, and summer cultivation: (1) To test winter sprays in conjunction with summer sprays; (2) to test soil-treatment.

In summing up the whole question, after consultation with the association's experiments advisory committee, I am unfortunately unable yet, from the results of one season of these experiments, to recommend any definite course of treatment for the control of brown-rot of the peach under adverse conditions. However, a very considerable amount of valuable information has been gathered from the work carried out. Confirmation of any theories arrived at as a result of these tests is required, and for this reason alone another season's tests at least on the same plots is necessary.

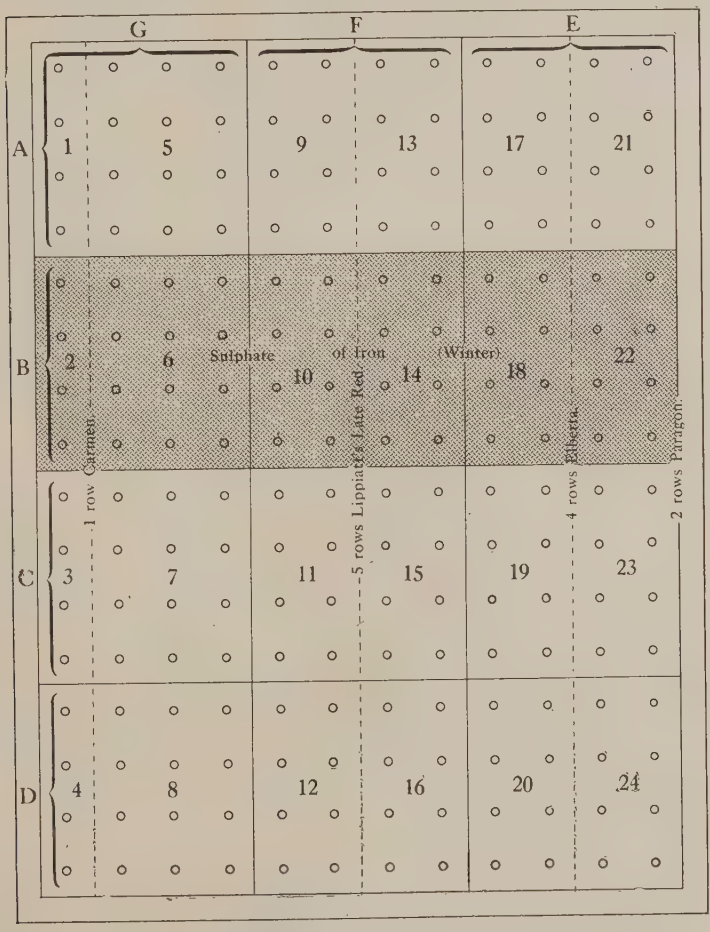
In my opinion the intensity of attacks from this disease are due firstly to weather conditions, secondly to soil and situation, and thirdly to variety. Up to last season it was generally held that the softer varieties of peaches were the most susceptible to the disease, and that the later varieties, being harder in texture, were much less susceptible to attack. This season's experience, however, has exploded that theory, as the later varieties suffered the more severely. Certainly the weather just at the time of the worst infection was extremely favourable for the development of spores (*i.e.*, bright sunshine and north-easterly wind on 16th and 17th February, after very heavy rain—causing very humid



BROWN-ROT EXPERIMENTS AT HENDERSON.—NO. I ORCHARD.

conditions); but this only goes to support my statement regarding the intensity of attacks, and the object we have in view is to be prepared against such attacks.

Undoubtedly the probability of infection increases as the fruit approaches the ripening-stage, and several varieties of peaches and



EXPERIMENTAL AREA IN NO. 2 ORCHARD.

nectarines suffer attack almost entirely during that period. However, from my own observations a considerable number of our best varieties are infected at the rate of 40 per cent. when quite green—chiefly just after stoning.

A considerable amount of personal observation was made in stone-fruit orchards from time to time during the whole season, and it appears to be quite evident that in practically every case where the picking-up and destroying of infected fruits has been neglected all measures for control, whether winter or summer, or both combined, were practically nullified. Where picking-up was resorted to, infection in many cases was noticeably less compared with instances in which no attention was paid in this direction.

Again, an orchard which received last season winter application of bordeaux (8-6-40) only, and no summer treatment with the exception of picking up of infected fruits, suffered less than 2 per cent. infection, but this season with the same winter treatment *only* it suffered heavy loss. Yet another orchard, which had also only received the bordeaux in spring (8-6-40) last season and suffered approximately 10 per cent. infection—with no destruction of infected fruits—was this season treated with two bordeaux sprays, one in the autumn and one in spring (8-6-40), followed by one lime-sulphur spray at fruit-setting (1 130) and another at same strength about two weeks later, and, with only few infected fruits destroyed, suffered a loss of over 50 per cent.

In addition to this we have the evidence of an orchardist who sprayed last season with bordeaux (8-6-40) in autumn and spring, not followed by summer treatment or picking up, losing about 45 per cent. from infection by brown-rot; yet this season, with bordeaux in autumn and spring (8-6-40), followed by atomic sulphur (8–100), with picking up, he lost over 60 per cent.

PROVISIONAL CONCLUSIONS.

As a result of one season's treatment of the areas under test it may be reasonably considered that—

1. Bordeaux (2-3-50) as a summer spray for peaches, after the fruit-set spray, is too strong—rather severe scorching resulting from its use. Especially was this noticeable at the time of the third application—*i.e.*, three weeks after the ripening of the first fruits. It is worthy of note that this same formula caused no damage to trees or foliage at the first spray—*i.e.*, at fruit-setting period—and it will be seen by the accompanying table that the applications in both No. 1 and No. 2 orchards gave some rather striking results.

2. Lime-sulphur and atomic sulphur in summer were both inclined to cause leaf-markings on all varieties treated—viz., Lippiatt's Late Red, Osprey, Elberta, and Carmen. Of these, Carmen treated with atomic showed least signs of damage. In no case, however, was the fruit marked or scorching of foliage anything but slight, and the damage was, practically speaking, immaterial.

3. The one season's treatment, under the existing weather conditions, of the trees on the areas under test, with any of the autumn and early spring sprays—bordeaux (8-6-40) and copper sulphate (1–15); or summer sprays—bordeaux (2-3-50), lime-sulphur (1–130), or atomic sulphur (8–100)—has been insufficient to produce results which show any favourable comparison with trees which received practically no attention beyond the one application of bordeaux in early spring.

4. Soil-dressings of sulphate of iron at the rate of 1 lb. and 2 lb. per tree showed no appreciable difference to the area so treated.

5. In so far as the very early spring infection is concerned, the trees in orchard No. 3 sprayed with copper sulphate (1–15) showed slightly better results than those which received the bordeaux (8-6-40). There was, however, no appreciable difference between the trees sprayed in autumn only and those sprayed both in autumn and spring.

6. Careful and judicious thinning of the fruits is essential, as a large percentage of infection occurs at the point of contact of fruits.

7. The picking and destroying of all affected fruits at the time of harvesting the crop is very essential, minimizing the number of spores available for further development and infection.

One instance which has come under my observation during the past season is that of an orchardist in this district who this season used bordeaux at the approximate strength of 8-8-40 in early spring as a peach-spray. With each 42-gallon barrel of the spray was mixed ½ pint of lysol. This was followed by a summer spray, about three weeks after stoning, with atomic sulphur (8–100), combined with ½ pint of lysol to each 42 gallons. This spray was mostly used on Golden Queens; no damage was caused by scorching, and out of eighty-three trees, carrying approximately a 1½-case crop per tree, only one case of brown-rot-affected fruit was gathered and picked up. It is interesting to note that last season about twenty-five cases were gathered, with four cases affected by rot. This is the one case which has come under my notice where a decrease of infection by brown-rot has been noted this season as compared with last.

I am inclined to suggest the adoption of the following measures as preventive treatment: Any affected fruits that may yet be left on the ground should, together with all mummified fruits, dead twigs, and shoots, be immediately collected and destroyed by burning. All prunings should be gathered up and burnt after winter pruning, and not stacked away in adjoining shelter-belts. Spray in autumn with copper sulphate (1–15), and in early spring, as the buds show pink, with bordeaux (8-6-40).

As far as summer control is concerned, a large amount of evidence has been collected, but, unfortunately, up to the present time a large proportion of this is of a conflicting nature. I consider that the most important times for applying a fungicide are immediately after pollination has taken place, again as soon as all the blossom petals have fallen, and, if necessary, again at the "early ripen" stage.

For the proper line of control, however, we must look to our test areas, from which we are expecting results next season which will give us a definite course for control.

In conclusion, I would like, on behalf of the Department, to thank the members of the Henderson Experiments Advisory Committee, the president and secretary of the Henderson Friutgrowers' Association, and the orchardists concerned —viz., Messrs. F. G. Platt, T. Colebrook, and J. and W. Bodley—for the interest taken in and valuable assistance afforded the Horticulture Division in the carrying-out of these experiments under adverse weather conditions. Thanks are also due to Mr. M. Pender, of Henderson, who placed his power sprayer at the disposal of the Department for the season in orchards Nos. 2 and 3.

BROWN ROT CONTROL EXPERIMENTS AT HENDERSON.—TABULATED RESULTS.

(F.S. indicates "fruit-set spray"; E.R. indicates "early-ripen spray.")

No. on Plan.	Winter.			Summer.			Result.			
	Spray.	Formula.	Application.	Spray.	Formula.	Application.	Number of Cases.	Number of Fruits produced.	Number of Fruits affected.	Per-centage.
				ORCHARD No. 1.—F. G. PLATT.						
1*	Bordeaux ..	8–6–40	May & Aug.	..	..	..	5½	440	45	10¼
2†	,, ..	,,	,,	..	..	..	3½	280	41	14¾
3	,, ..	,,	,,	..	..	..	3½	280	84	30
4	,, ..	,,	,,	Atomic sulphur	8–100	E.R. & 3 wks. later ..	4	320	49	16
5	,, ..	,,	,,	,,	,,	F.S., E.R., & 3 wks. later	5½	440	76	17⅞
6	,, ..	,,	,,	Lime-sulphur ..	1–130	E.R. & 3 wks. later ..	2½	200	46	23
7	,, ..	,,	,,	,, ..	,,	F.S., E.R., & 3 wks. later	3½	280	44	15⅝
8	,, ..	,,	,,	Bordeaux ..	2–3–50	E.R. & 3 wks. later ..	14½	1,160	79	6¼
9	,, ..	,,	,,	,, ..	,,	F.S., E.R., & 3 wks. later	11½	920	34	3⅝
10*	,, ..	,,	Aug. only ..	..	..	..	5	400	39	9¾
11†	,, ..	,,	,, ..	..	..	..	5½	440	51	11⅝
12	,, ..	,,	,, ..	..	..	..	5	400	43	10¾
13	,, ..	,,	,, ..	Atomic sulphur	8–100	E.R. & 3 wks. later ..	3½	280	42	15
14	,, ..	,,	,, ..	,,	,,	F.S., E.R., & 3 wks. later	5	400	38	9½
15	,, ..	,,	,, ..	Lime-sulphur ..	1–130	E.R. & 3 wks. later ..	3	240	38	15⅝
16	,, ..	,,	,, ..	,, ..	,,	F.S., E.R., & 3 wks. later	4½	360	80	22¼
17	,, ..	,,	,, ..	Bordeaux ..	2–3–50	E.R. & 3 wks. later ..	15½	1,240	110	8⅞
18	,, ..	,,	,, ..	,, ..	,,	F.S., E.R., & 3 wks. later	14	1,120	31	2¾
19*	Copper sulphate ..	1–15	May & Aug.	..	..	..	6½	520	66	12¾
20†	,, ..	,,	,,	..	..	..	7	560	44	7⅞
21	,, ..	,,	,,	..	..	..	5	400	57	14¼
22	,, ..	,,	,,	Atomic sulphur	8–100	E.R. & 3 wks. later ..	5	400	42	10½
23	,, ..	,,	,,	,,	,,	F.S., E.R., & 3 wks. later	4½	360	26	7¼
24	,, ..	,,	,,	Lime-sulphur ..	1–130	E.R. & 3 wks. later ..	2½	200	22	11
25	,, ..	,,	,,	,, ..	,,	F.S., E.R., & 3 wks. later	4	320	81	25 5/16
26	,, ..	,,	,,	Bordeaux ..	2–3–50	E.R. & 3 wks. later ..	18½	1,480	87	5⅞
27	,, ..	,,	,,	,, ..	,,	F.S., E.R., & 3 wks. later	8	640	70	10⅞

28*	Copper sulphate..	1–15	Aug. only ..	..	..	..	7½	600	54	9
29†	,, ..	,,	,, ..	..	..	..	6	480	46	9⅔
30	,, ..	,,	,, ..	..	..	..	6	480	54	11¼
31	,, ..	,,	,, ..	Atomic sulphur	8–100	E.R. & 3 wks. later ..	6	480	64	13⅓
32	,, ..	,,	,, ..	,,	,,	F.S., E.R., & 3 wks. later	5½	440	40	9
33	,, ..	,,	,, ..	Lime-sulphur ..	1–130	E.R. & 3 wks. later ..	2½	200	23	11½
34	,, ..	,,	,, ..	,, ..	,,	F.S., E.R., & 3 wks. later	5½	440	99	22½
35	,, ..	,,	,, ..	Bordeaux ..	2–3–50	E.R. & 3 wks. later ..	13	1,040	94	9
36	,, ..	,,	,, ..	,, ..	,,	F.S., E.R., & 3 wks. later	11	880	43	4⅔

ORCHARD No. 2.—T. COLEBROOK.

G 1	Bordeaux ..	8–6–40	May & Aug.	Atomic sulphur	8–100	F.S. & E.R.	30	2,400	38	1⅜
2‡	,, ..	,,	Aug. only ..	,,	,,	,, ...				
3	Copper sulphate..	1–15	May & Aug.	,,	,,	,, ...				
4	,, ..	,,	Aug. only ..	,,	,,	,, ...				
5	Bordeaux ..	8–6–40	May & Aug.	,,	,,	F.S.	160	12,800	9,600	75§
6‡	,, ..	,,	Aug. only ..	,,	,,	,, ...				
7	Copper sulphate..	1–15	May & Aug.	,,	,,	,, ...				
8	,, ..	,,	Aug. only ..	,,	,,	,, ...				
F 9	Bordeaux ..	8–6–40	May & Aug.	Lime-sulphur ..	1–130	E.R.	120	9,600	7,200	75
10‡	,, ..	,,	Aug. only ..	,, ..	,,	,, ...				
11	Copper sulphate..	1 15	May & Aug.	,, ..	,,	,, ...				
12	,, ..	,,	Aug. only ..	,, ..	,,	,, ...				
13	Bordeaux ..	8–6–40	May & Aug.	..	..	..	34	2,720	60	2½
14‡	,, ..	,,	Aug. only ..	..	..	..				
15	Copper sulphate..	1–15	May & Aug.	..	..	..				
16	,, ..	,,	Aug. only ..	..	..	..				
E 17	Bordeaux ..	8–6–40	May & Aug.	Bordeaux ..	2–3–50	F.S.	38	3,040	59	1⅞
18‡	,, ..	,,	Aug. only ..	,, ..	,,	,, ...				
19	Copper sulphate..	1–15	May & Aug.	,, ..	,,	,, ...				
20	,, ..	,,	Aug. only ..	,, ..	,,	,, ...				
21	Bordeaux ..	8–6–40	May & Aug.	,, ..	,,	,, ...	36	2,880	56	1⅞
22‡	,, ..	,,	Aug. only ..	,, ..	,,	,, ...				
23	Copper sulphate..	1–15	May & Aug.	,, ..	,,	,, ...				
24	,, ..	,,	Aug. only ..	,, ..	,,	,, ...				

* Received soil-dressing of sulphate-of-iron powder at rate of 1 lb. per tree in July. † Received soil-dressing of sulphate-of-iron solution at rate of 2 lb. per tree in May.
‡ Received soil-dressing of sulphate of iron at rate of 1 lb. per tree in winter. § One row Lippiatt's next to Carmen row received two sprays same strength—viz., F.S. and E.R.

RENOVATION OF PASTURE.

TOP-DRESSING TEST IN WAIPUKURAU COUNTY.

G. DE S. BAYLIS, Fields Supervisor, Napier.

FIORIN and vernal have practically taken possession of large areas of land in Waipukurau County, Hawke's Bay, especially of those parts belonging to or adjacent to the Hatuma Flats. Great difficulty is experienced in getting rid of the fiorin. Endeavour is usually made to do so by ploughing and taking a few crops off the land before again putting it down to grass, but in a great many cases the fiorin soon again gets the upper hand and the pasture rapidly loses the other grasses. It was therefore decided last year by the Hawke's Bay Farming Development Association to conduct a test to endeavour to ascertain if by top-dressing the better grasses would be stimulated and helped to hold their own against the fiorin, and thereby the life of the pasture prolonged before it again became necessary to replough same; also to ascertain what increase, if any, in the carrying-capacity of land so treated could be effected; and the cost of the operation.

The area used for the test is a paddock of 28 acres offered by Mr. A. F. Cook, on his property at Farm Road, Waipukurau. The paddock was divided into two equal areas of 14 acres each, one to be top-dressed and the other left untreated. The number of sheep needed to keep the grass down in each area was to constitute the record. Hence the results would be stated in the number of sheep carried per acre on each area, and the cost of top-dressing per acre on the top-dressed area.

The fertilizers used for top-dressing were as follows: Japanese super, 141 lb.; Ephos phosphate, 112 lb.; bonedust, 28 lb.; dried blood, 28 lb.: a total of 309 lb. of mixture per acre. The following shows the cost per acre: 309 lb. fertilizer, £1 4s. 6d.; freight, 1s.; cartage, 1s. 5d.; harrowing, 1s. 6d.; drilling, 2s.: total, £1 10s. 5d. It may be noted that at normal pre-war prices the same mixture would have been obtainable at a price of 17s. 6d., or less, per acre, instead of £1 4s. 6d.

The top-dressing was applied on 18th August, 1917, both paddocks having been previously heavily grazed to clean up any roughage. The areas were stocked with sheep from 31st August in numbers varying with the condition of the pasture. Detailed notes were taken

regarding the condition maintained by the stock and the state of the pasture on the respective areas. Summarizing these data it may now be recorded that between 31st August, 1917, and 21st March, 1918, the top-dressed paddock carried an average of 8·3 sheep per acre, as against 6·4 sheep per acre on the untreated area. At time of writing (25th April) there are 8½ sheep per acre on the top-dressed paddock, and 5 sheep per acre on the unmanured area. It is interesting to note that after 22nd December the unmanured area, which for a short time had been carrying 9·2 sheep per acre, receded to 7·7 sheep per acre, at which date and for some time previously the top-dressed area was carrying 11 sheep per acre.

The grazing of both areas has been almost continuous from the time of starting, with the exception of two short intervals in order to permit the paddocks to sweeten, the number of sheep carried having a tendency to make the paddock somewhat foul.

It will be seen that so far the trial has given good results. The questions that remain to be further determined are (1) for how long such a dressing increases the carrying-capacity of the pasture, and (2) the cost per head of grazing sheep upon pasture so treated as compared with untreated pasture. If the answer to the latter question, which is really the sequel to the first question, is satisfactory, then it would appear that the economy of practical grazing in the class of country experimented with could be largely influenced by the judicious use of suitable fertilizers wherever freights and prices did not render the cost prohibitive.

YOUNG FRIESIANS AT WERAROA.

THE MANUFACTURE OF FUEL ALCOHOL FROM SAWDUST AND TIMBER WASTE.

B. C. ASTON, F.I.C., Chemist to the Department.

ACCORDING to Professor Vivian Lewes, a distinguished authority, the world's stores of petroleum, coal, and shale are all being rapidly depleted, and in the not very distant future it will be to alcohol that we shall have to turn. It will then be found that alcohol, denatured with 10 per cent. of benzol and tinged by a trace of aniline dye, will give a motor-spirit at once safer, more pleasant in use, and sweeter in exhaust than the petrol of to-day; further, that, although the calorific value of such a mixture is only 0·6 of the value of petrol, the smaller amount of air needed for its combustion, the increased explosive range of mixture, and the higher compression that could be used in the cylinder all combine to make it the ideal motor-spirit, and one about which no doubts can be raised as to the possibility of future supply. The foregoing statement is derived from the *Chemical World* of April, 1913, and, according to the September, 1913, issue of the same publication, if alcohol can be produced at anything under 1s. a gallon it will compete with petrol and stand a good chance in the future of being recognized as the ideal spirit. Moreover, the change involved in methods of manufacture would certainly be beneficial to Great Britain.

The *American Lumberman* of 19th December, 1914, stated that the production of ethyl alcohol from shredded wood or from sawdust was being carried out on a commercial scale in the United States, and that this process held great promise for future development. There did not seem to be any great difficulty in securing the proper chemical reactions, but much difficulty had been encountered with the mechanical details of the various plants used to experiment with this process. Yields of from 16 to 24 gallons of alcohol per ton of sawdust had been claimed.

The essential parts of a plant necessary for the production of ethyl alcohol from wood, the forest-products authorities point out, considered in the order of their use, are as follows: Adequate sawdust-storage; disintegrating-equipment — hogs, screens, shredders; sawdust-storage above digesters; acid-storage; digesters; diffusion battery; neutralizing and settling tanks; coolers; fermenters and yeast-equipment beer-still; rectifying-still; bonded warehouse; boilers and engines; laboratory and office.

It is estimated by the United States Forest Products Laboratory that a properly constructed plant, convenient to an adequate supply

of waste wood, with plenty of good water and sulphuric acid easily accessible, and designed to produce from 2,500 to 3,000 gallons a day, can make ethyl alcohol at a cost from 14 to 20 cents a gallon, including all overhead expenses. This latter statement is from the *American Lumberman* of 4th August, 1917.

The Advisory Council of Science and Industry of Australia, in their *Bulletin* No. 6, on Power Alcohol (Melbourne, 1918),* are of opinion that though the proposal to utilize sawdust as a source of alcohol is obviously attractive, an examination of the information available leads to the conclusion that the chemistry underlying the process is not sufficiently advanced and that the technological methods are not sufficiently developed to justify the belief that the process is capable of competing successfully, in Australia at any rate, with the usual methods for the manufacture of alcohol from saccharifierous (sugary) and amylaceous (starchy) substances. The practical difficulties in the conversion and working of the Claassen process are largely physical, as the chemical conversion and fermentation appear to be comparatively simple. There is every reason to believe that the success of the process will ultimately be achieved with the development of technology, but Australia is at a disadvantage in having timbers which are much more refractory than the softwoods of other countries. Moreover, Australia is, comparatively speaking, a poorly timbered country, and even in those countries which have, in addition to their other advantages in this respect, unlimited water-power and waterways to serve the timber industry this process does not appear to have been yet established permanently.

In connection with the subject of alcohol from cellulose, it may be stated that at least two patents, one French and one English, have been taken out for the manufacture of alcohol from peat, the process being akin to the Claassen process. As regards the utilization of the waste lyes from sulphite wood-pulp mills, in Sweden about a million and a quarter gallons of alcohol are produced annually from the sulphite liquor in three paper-mills, whilst in the United States two similar plants have been established. It is stated that the process is promising in many respects. It seems probable that if some modification of the Claassen process can be successfully applied to the waste timber and sawdust of Australian sawmills a suitable source of alcohol would be obtained, and a considerable saving of wood now wasted would be effected.

No attempt has been made to manufacture ethyl alcohol from wood waste in New Zealand by the Claassen or any other process, and the information here given refers to the American experience. The writer, however, will be glad to supply any company contemplating the manufacture of such alcohol with references to all the literature at his disposal.

* Possibly the information the Council had at their disposal was not so recent as some of the American experience quoted above.

BLACK-SPOT OF PEAR.

AN ORCHARDIST'S CONTROL EXPERIENCE.

J. G. VEALL, Henderson.

[In the monthly Orchard notes in the *Journal* for March last mention was made of a case of successful control of black-spot, despite unfavourable climatic conditions, in a district where the disease was prevalent. The orchardist concerned is Mr. J. G. Veall, of Henderson, Auckland. This matter was discussed before the recent conference of the Fruitgrowers' Federation at Auckland, with Mr. Veall present to supply the necessary details. Mr. Veall has kindly furnished the following account of his operations for the *Journal*.]

I HAVE been requested by the Horticulture Division to write a few notes on the result of spraying for the control of black-spot of pears during the past season, and I readily accede to the request, not with the idea of posing as an authority, but simply to put before any pear-growers who may be troubled with this disease details of methods used in my orchard, and results obtained, hoping they may be of some interest and benefit.

In the first place, I would mention that I have 6 acres of pear-trees, about twenty-five years old, and planted 24 ft. apart. More than one-half of these are Bon Chrétiens, the remainder being composed of several varieties. In the first season (1915) after taking over this orchard I experienced as bad an attack of black-spot as perhaps it is possible to have, both fruit and foliage being very badly affected indeed. This was the result of not using bordeaux, and not paying proper attention to spraying; and but for the courtesy of the Director of the Horticulture Division in allowing the best of the pears to be sold, the entire crop, with the exception of a few varieties, would have been lost.

This disastrous start made me turn my attention to combating the disease—no light matter considering the hold it had then obtained. In 1916 I used the winter formula of 10-10-40 bordeaux, and 4-4-40 after the fruit had set. The result was certainly a great improvement compared with the previous year, but very far from satisfactory, the percentage of unsaleable pears being still very high. In 1917 I tried the new formula recommended by the Department, of 8-6-40 bordeaux in winter, 6-4-50 pink spray, and 3-4-40 with first arsenate spray. Unfortunately, the pear crop generally (as pear-growers will remember) was a dismal failure, and the results could not well be gauged. What small quantity of fruit there was, however, was sufficiently clean to determine me to again employ the methods advocated by the Depart-

ment, and I will record the period of spraying, strength of spraying, and quantity used during the season now closing, as follows :—

Winter spray—applied when buds are swelling :—

Date.	Formula.	Quantity.
Aug. 29	Bordeaux, 8-6-40	100 gallons.
Sept. 15	,,	60 ,,
,, 17	,,	160 ,,
,, 18	,,	160 ,,
,, 19	,,	160 ,,
,, 20	,,	160 ,,
,, 22	,,	240 ,,
		1,040

Pink spray—applied when cluster-buds had opened and blossom was beginning to show colour :—

Sept. 27	Bordeaux, 6-4-50	90 gallons.
Oct. 2	,,	120 ,,
,, 6	,,	80 ,,
,, 10	,,	110 ,,
,, 11	,,	120 ,,
,, 12	,,	240 ,,
,, 13	,,	80 ,,
		840

Summer spray—applied when fruit had set, combined with first arsenate spray :—

Oct. 25	Bordeaux, 3-4-40	80 gallons.
,, 26	,,	80 ,,
,, 29	,,	160 ,,
,, 30	,,	160 ,,
Nov. 1	,,	240 ,,
,, 2	,,	240 ,,
		960

This last-mentioned spray was the only one in which the formula used differed from the recommendation of the Department. I applied the 3-4-40 bordeaux instead of 2-3-40, as just at that period very humid weather conditions prevailed, and I deemed it advisable to apply a slightly stronger spray. If I erred it was, at any rate, on the right side. I do not think the stronger spray had any bad effect, as the crop showed very little sign of russeting. With every subsequent arsenate spray I applied lime-sulphur 1–100.

Having given details of the application, I come to the results. The crop generally this past season was below normal in quantity—I believe this was so over most of the Dominion—and some varieties failed entirely. As I have before mentioned, my main crop consists of Bon Chrétiens (a variety I have found very subject to black-spot), and the crop of this variety harvested was 789 cases. All pears having the slightest touch of black-spot were discarded when packing, and the quantity noted, the result being that 30½ cases, or 3·87 per cent., were discarded, leaving over 96 per cent. free from spot.

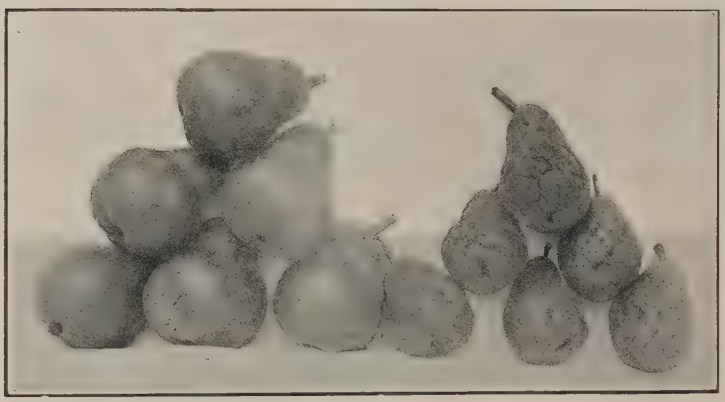
The percentage of other varieties worked out as follows : Crop sold, 389½ cases ; discarded for black-spot, 13¼ cases ; percentage of black-spot, 3·4 ; percentage free from black-spot, 96·6. These varieties consisted of the following : Beurré Diel, Brown Beurré, Fertility, Vicar of Winkfield, Keiffer, Beurré Clairgeau, P. Barry, Beurré de Rika, L'Inconnue, and Marie Louise d'Uccle ; also a few trees of Louise

Bonne of Jersey, Glou Morceau, Beurré Bosc, and President Drouard. The crop of these was far below normal—in fact, one or two varieties failed entirely.

I found that fully 75 per cent. of the pears affected were borne at the tops of the trees, just where the spray failed to reach them, this being very noticeable when picking.

Altogether I am extremely satisfied with the results obtained, especially as the past season has been an exceptionally bad one as regards weather conditions. In order to obtain satisfactory results, however, the following points should not be lost sight of: —

(1.) Spray at the right period. The trees are not ready all at the same time, even those of one variety; they should be watched carefully and sprayed just when ready. The dates given in the foregoing record will show that the different sprayings extended over a considerable period.



BON CHRÉTIEN PEARS OF MR. VEALL'S 1917–18 CROP.

On left, samples from the 96 per cent. of clean fruit; on right, spot-affected fruits taken from tops of trees where spray failed to reach them.

(2.) Spray thoroughly. The cost of a little extra spray will be very small when compared with the results obtained. Even at the present high rates for spraying materials I find the cost works out at under 3½d. per case for bluestone, lime, and lime-sulphur.

(3.) Spray at high pressure: this is necessary. Personally, I use one of Cranwell's power sprayers, and find it very satisfactory. I have been using a pressure of from 200 lb. to 210 lb., but intend increasing the pressure next season, so as to drive the spray well into the tops of the trees.

It should not be inferred from the foregoing notes that I claim I can always obtain a similar result. Circumstances may be such that the result of next season's spraying will not turn out as satisfactory—this remaining to be seen. I have merely given the methods carried out and results obtained during the past season.

WORK FOR THE COMING MONTH.

THE ORCHARD.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

WORK in the orchard during the month of June may be of a general nature applicable to the dormant season. It is, however, advisable to undertake this work after the manner indicated in last month's *Journal*. Prune the trees and thoroughly clean up the orchard; plough under all dead leaves and fruit, surface soil, &c. See that all hedges are cut and drains attended to. The importance of thorough drainage has been emphasized in many orchards during the past year or two. Bad drainage increases the danger of sour-sap, which disease has taken a heavy toll not only of young but of mature trees, as a result of the recent wet seasons.

Spraying is a matter that can be well left till the approach of spring —in fact, it is more effective when applied at that time; but in the meantime all other work should be pushed on, so that there will be little other than the weather that will be likely to interfere with the thorough carrying-out of the spraying operations when the proper time arrives. Nothing can be done for either brown-rot or black-spot until the time of the colour-bud spray, other than thoroughly cleaning up the orchard preparatory to spraying, as previously indicated.

THE NATIONAL APPLE SHOW—STANDARDIZED JUDGING.

The judging of the fruit at the recent National Apple Show, at Auckland, was looked forward to with interest by those intimately concerned in the exhibition of fruit. It will be remembered that some time ago the New Zealand Fruitgrowers' Federation made a definite attempt towards the standardization of fruit-judging rules with a view to bringing about more uniformity throughout the country in judging awards. These rules were to be put into effect at the National Apple Show, hence the interest referred to.

Although I understand no report has yet been made by the judges on the matter, I think I can safely anticipate that report by saying that the standard rules in the main worked out highly satisfactorily. An earnest of this is to be found in the almost total lack of dissatisfaction displayed by the numerous competitors. Only in one instance did I hear of complaint, and this referred to a matter not clearly provided for in the standard rules.

It is not claimed that the standard rules and score-cards are by any means perfect, and suggestions will no doubt be made from time to time until a more perfect system is devised. The process of judging along these lines is slow and trying, but it is infinitely more satisfactory, when

completed, to both the judge and the competitor. The principle is sound, and all that remains is, if possible, to improve the system.

IMPROVED FRUIT-PACKAGES.

One section of the show that was of considerable interest to commercial fruitgrowers was that of fruit-package exhibits. Class 140 was for the best 5 lb. and 10 lb. packages of apples with crate, container to hold when packed eight 5 lb. or four 10 lb. packages; first prize, £5. This was won by Mr. R. O. Roberts, of Henderson, who went further than was required of him by staging a very ingenious collapsible crate.

Class 141 was for the best collapsible returnable one-bushel case for apples.

In this class the Federation, in consideration of the decreasing supply of box-timber and the increased cost of cases, had decided to offer a £10 prize for the best case exhibited, should such case be considered by the judges to be of sufficient practical value. The response was highly gratifying. Several cases of different designs were exhibited, and in practically every instance these were highly ingenious, reflecting great credit on the designers. Case No. 1, exhibited by Messrs. Thorp, Argue, and Stratford, was considered by the judges to be the most practical of the class, and was therefore declared to be the winner. Case No. 3 was, however, of such undoubted merit that £3 of the prize-money was awarded to the exhibitor, Mr. R. O. Roberts, of Henderson. The judges recommended that a number of cases of Nos. 1 and 3 pattern be purchased by the Federation, and put into practical use under equal conditions, with a view to thoroughly testing them under working-conditions. It was agreed, on the consent of the Director of the Horticulture Division, to leave the testing of the cases in the hands of the Department.

THE FEDERATION CONFERENCE—STANDARD FRUIT-CASES.

The annual conference of the Fruitgrowers' Federation, which was held at Auckland, coinciding with the Apple Show, dealt with many matters of immediate practical importance to the fruitgrowing industry, including sprays, spray-testing, brown-rot and black-spot control, &c., also the very vexed question of the standardization of fruit-cases. In this last matter, although all classes of fruits have not been provided for, very satisfactory progress has been made in definitely fixing the standard sizes of cases to be used in the sale of pip-fruits, peaches, nectarines, and plums.

The inside measurements of the cases decided upon are as follows:—

Pip-fruits: 10 in. by 11¼ in. by 19¾ in.; 5 in. by 11¼ in. by 19¾ in.; 7 in. by 8 in. by 19¾ in.; quarter-bushel case (size to be fixed by Federation directors). Tray, 11¼ in. by 19¾ in.; fruit to be packed one layer deep only; three trays to be cleated together to form a package.

Peach, nectarine, and plum: 5 in. by 11¼ in. by 19¾ in. (light partition optional); 7 in. by 11¼ in. by 19¾ in.; 6 in. by 7 in. by 28 in. (with partition). Tray as for pip-fruits.

Citrus fruits, apricots, cherries, grapes, tomatoes, &c., may be sold in any of the cases specified, or as previously.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

PRECAUTIONS AGAINST DISEASE.

JUNE is one of the worst months of the year for disease infection among poultry, especially diseases which have their origin in colds. It is therefore imperative that a keen watch should be kept over the birds, especially the young ones, and if the slightest symptom of cold is observed the affected bird should be promptly isolated. It should be remembered that colds are the forerunner of roup, and once this gains a foothold it is almost a hopeless matter to attempt to check it, or, if it is checked, very serious loss will have taken place.

The most common symptoms of colds are sneezing, eyes watering, and a discharge from the nostrils, to which dust and dirt usually adhere. Colds are mostly caused by exposure to cold and wind, and ill-ventilated or draughty houses, while damp, dirty, or overcrowded quarters are often responsible. Once a case of cold makes its appearance every endeavour should be made to find the cause and remove it at the earliest possible moment, while isolation of the affected birds is the only safe course. A good plan at this time of year as a preventive against colds is to place some Condy's crystals in the drinking-water. Put half a teaspoonful of the crystals into a pint bottle of water, and add a dessert-spoonful of this mixture to about 2 quarts of drinking-water.

As a cure for colds, or when these have developed into roup, a simple method of treatment is to dip the bird's beak into pure kerosene, sufficiently deep to cover the nostrils, and hold the bird in this position until it breathes. This will have the effect of drawing the kerosene to the seat of the trouble. The treatment should be repeated daily, or at least on alternate days. Care must be taken that the kerosene does not get on to the bird's face or comb, or it may have the effect of scalding these parts as well as causing suffering to the bird. The best plan is to wipe the beak with a piece of cloth after each operation.

As with most other troubles affecting poultry, attempting to cure colds is the last resource, and one which cannot enter into practical poultry-keeping. Time and again the advice has been given in these pages that prevention is the only safe policy in warding off disease. The first essential to this is to see that the stock possess the necessary constitution to combat the attack of any disease. But this is not enough. The houses should be absolutely draught-proof and maintained in a thoroughly sanitary condition. The runs should not be allowed to become stale and a breeding-ground for disease. Where possible, alternate runs should be provided so that the birds may occasionally have a change on to fresh clean ground. Then, constant warfare should be waged against vermin. It is impossible to keep fowls in a healthy state when these are present. Above all, the birds must have an abundant supply of good, nourishing food. Underfeeding has the effect of not only retarding egg-production, but, in addition, tends to weaken the constitutional vigour of the bird, and makes it susceptible to every passing ailment.

WINTER EGGS.

With the present high values ruling for guaranteed fresh eggs there is every encouragement to "do" the pullets well, though to secure the best results from them they should have been done well from the brooder stage. It is from the pullets that the great bulk of winter eggs must be secured. It is only exceptionally that a bird in her second year or older will be laying now. It is therefore essential that special care should be taken for the comfort of the pullets at this period of artificially stimulated production.

In the first place, a snug but open-front house should be provided. It is also essential that exercise be stimulated. This can be best induced by having the floor covered with litter 3 in. or 4 in. thick, in which the evening meal of grain is scattered. It is always a good plan to give a little more food at this meal than is required, so that the birds will have something to scratch for in the early morning, and thus obtain the necessary exercise.

As to diet, there are many different rations that will produce good egg-yields. The main aim is to see that the food is of good quality and fed in abundance. Then, of course, to secure winter eggs the ration must be of a forcing nature. When boiled meat is not obtainable meat-meal will make a good substitute. This material may be supplied in the morning mash at the rate of 8 per cent.—by weight—of the aggregate weight of the mixture when dry. The feeding should be regular, and no experimenting should be attempted. Then it should be made as appetizing as possible, and no unnecessary variation in the class of food should be permitted. There is no better way of forcing the pullet into a false moult than by changing her food or quarters at this season of the year. The laying-pullet should be made contented, and only in this condition can it be expected to do its best. A good roomy house kept in a sanitary state, a plentiful supply of nourishing food, a daily ration of green stuff, together with clean water, grit, and a good dust-bath, are of great importance in assisting a pullet to produce her maximum egg-yield.

SECOND-SEASON HENS.

The bulk of the second-season hens are now finishing up their moulting process, and consequently have not yet commenced another period of production. But this does not imply that they should be neglected in any way. It is well to remember that the process of renewing its old feathers is as great a drain on a hen's system as the production of eggs. She therefore demands every care and attention in order that she may recoup her strength and resume laying again in the shortest time possible. Especially does this apply with the bird it is intended to breed from, and where early eggs are required for reproductive purposes. In the first place, she must be well fed if her next season's egg-yield is to be profitable and the eggs are to contain the desired strength of germ to produce strong healthy chicks. It is always a foolish policy to stint a hen of its food merely because she is temporarily out of action. Good nourishing food is just as essential when the bird is taking her natural rest as when she is at the top of her laying-period. Usually a bird after passing through the moult craves for a change of diet; it is therefore well to give a little variety to the ration. Maize may with advantage be added to the grain ration, while, as already mentioned,

a supply of meat or meat-meal will do much to promote egg-production. A good supply of green food is essential, nothing being better than lucerne or watercress. Where these are not available, turnips, cabbage, mangels, &c., may be given whole for the birds to pick at. In short, everything should be done to maintain the bird in a healthy, thriving condition, in order that she may be in perfect "nick" to start her second season's production.

THE DEVELOPING PULLETS.

Many cases have recently come under my notice of pullets not growing to the desired size, nor commencing to lay when expected. In some flocks the stocks were hatched at the right period—being about six months old at the time of inspection—but yet exhibited a weedy, backward appearance. In some cases the unsatisfactory condition of the birds was due to insufficient food being supplied, as well as to wrong management generally. In other instances the birds were well cared for, and an abundance of food was provided, but of the wrong kind. For example, some of the breeders adhered strictly to the old system of making the morning mash with two parts of pollard to one of bran, quite forgetting to take into account the inferior quality of the pollard they were using. This, as is now usually the case, was more like bran than the genuine article. It only stands to reason that a light diet of this kind would not tend to promote proper development in growing stock. It is a rare thing at present to see good pollard, and it would therefore appear that a substitute will have to be found to wholly or partially take its place. A good material for this purpose is ground wheat. One part of wheat-meal to two parts of bran is recommended, the proportions being varied according to the quality of the wheat before being ground. Usually only wheat of inferior quality is used for such grinding purposes, and breeders are therefore recommended to choose their own sample and get it ground accordingly.

THE APIARY.

E. A. EARP, Apiary Instructor.

WINTER PRECAUTIONS.

BEFORE the cold weather sets in every hive should be examined to see that the frames are completely covered with sufficient dry well-fitting mats to keep the bees protected. Wherever a damp or mouldy mat is discovered it should be replaced by a dry one, and the roof examined and repaired. No draughts should be allowed around the frames. Mats made of corn-sacks cut to the exact size of a zinc queen-excluder answer all requirements of warmth. Be sure they are placed in their exact position. If placed crookedly the edges are apt to be pushed out between the hive-body and the roof, and will in time absorb enough moisture to make them damp and unwholesome.

Once more the time approaches when the necessity for shelter should impress itself on the beekeeper. It is most essential that the bees be protected from cold winds during the winter. Should no permanent shelter be available something temporary should be erected—if the bees are expected to prove in normal condition in the spring. Manuka scrub is excellent for making a temporary wind-break.

MARKETING THE CROP.

Whatever the market for which the beekeeper designs his crop, every care should be taken to see that the regulations regarding sales are observed. It is too late this season to impress on beekeepers the advisability of putting his honey in new tins for the oversea market, but it is to be hoped that before next season arrives they will have grasped the fact that the use of petrol-tins is a retrograde step in an otherwise promising industry. Be sure that all honey intended for export is thoroughly granulated, the tins either lacquered or oiled on all sides externally, and the cases wired or bound with metal strapping prior to despatch to the grading-store. For local trade clean attractive packages are, of course, a necessity, and, in accordance with the Sale of Food and Drugs Act, they must be plainly marked with the producer's name and address and description of the contents, including the net weight. No honey should be labelled "pure clover honey" unless the beekeeper is certain that the bees worked no other flowers. The correct description of most lines is "pure honey." It is no unusual thing to see honey of a dark-amber tint labelled "pure clover." This is incorrect and misleading, as clover honey is among the whitest produced.

SAVING THE WAX.

The demand for wax by manufacturers for use in the preparation of various proprietary articles has never been greater than at the present time, and the price offering is such as to tempt many beekeepers to dispose of supplies without contemplating the ultimate cost of comb-foundation. To-day dealers in beeswax are scouring the country for stocks, and every ounce secured is lost to the beekeeping community. The position is acute, and is such that not one pound should be sold unless it is known that it is going into the hands of beekeepers who are making up foundation. The price of imported foundation has of late years steadily advanced, and the latest indications are that the cost to purchasers will, for the coming season, reach 4s. per pound. The advanced cost has been brought about mainly by the difficulty of securing transport, by higher freights, and the steadily advancing rates ruling for beeswax in America, from which country supplies of comb-foundation are mainly drawn. It therefore behoves every beekeeper to save every ounce.

The annual wastage of wax is very great, and it is safe to assert that if more care were exercised by the beekeepers there would be ample for local requirements. No industry can be carried on successfully without ample supplies of raw material, yet beekeepers are annually wasting or destroying by fire large quantities of raw material which should go to cheapen the cost of production and add to the profits of the apiary. There is quite a number of comb-foundation manufacturers in the Dominion, and to their credit it may be said that they are on the whole turning out an article quite equal to the imported. Their main difficulty is in obtaining beeswax to carry on, while their customers are disposing otherwise of the raw material which could be converted into foundation. Manufacturers are working up wax into foundation at 8d. to 9d. per pound. This is reasonable when the skill and time necessary to manufacture a good article is taken into consideration. The saving to the beekeeper who has his wax

converted is approximately 1s. 6d. per pound, and where increase is desired, or in the case of the less fortunate beekeeper who has to treat for disease, the saving is at once apparent.

The New Zealand Co-operative Honey Producers' Association, which started its existence in 1913, has steadily organized on co-operative lines, and to-day it is capable of handling the whole of the honey produced in the Dominion. At this juncture it would appear that the co-operative principle could be extended by securing to the shareholders cheap supplies of comb-foundation in addition to other requisites of the apiary.

TREATMENT OF WAX.

With the advent of colder weather the beekeeper should turn his attention to the proper treatment of his wax. There is little peace for the bee man who endeavours to render wax during hot weather unless he works in a bee-tight room or at some distance from the apiary. Nothing attracts the bees like the smell of melting wax. However, the wax should be treated or clarified in good time, so that if the beekeeper decides to have it converted he will be able to place his order so as to have his foundation ready before next season is upon him. If he possesses a solar extractor and has put it to good use much of his wax will require little treatment to become a first-class article. The cakes from the solar extractor should be scraped of any refuse which may cling to them, and melted in clean, hot water. If possible, do not allow the wax to boil. The water should be hot enough to completely melt the wax, which should be well stirred during the process. After it is melted the vessel containing the water and wax should be set aside to cool as gradually as possible. A petrol-tin is a handy utensil in which to clarify wax in quantities up to 10 lb. or 12 lb., and this can be placed inside a wooden box, and packed on all sides with corn-sacks or sawdust and similar material to prevent rapid cooling. Be sure the top surface of the tin is covered. This gradual cooling not only assists the clarifying, but also ensures that the cakes will remain uncracked. When cold the cake of wax can be removed from the water and once more scraped, when it will usually be found fit for foundation-making or any other purpose.

Where the wax still exists as old combs, burr-combs, or other forms common to an apiary it should first be melted in quantity in a copper or similar large vessel, and afterwards put through a wax-press. Of these latter, the steam-heated one is the best on the market, and is an absolute necessity where large quantities of comb are to be handled. The melted wax and water are poured into a scrim bag inside the press, where pressure may be applied when the water and wax cease to flow freely. The scrim bag retains the slum-gum, and there will be a steady stream from the escape-pipe into whatever receptacle is provided. Again, a benzine-tin is a handy utensil. As the water and wax fill the tin the use of a kerosene-pump is of service. It reaches the bottom of the benzine-tin, and the water can be drawn off and the wax left in the tin, thus obviating the use of too many containers. As before, the wax should be cooled, immersed in fresh water, and melted until the cakes attain the standard of commercial cleanliness. The slum-gum obtained in the process must be carefully gathered up and destroyed by fire.

PLANS FOR NEXT SEASON.

During the off season is the best time to make plans for the following season. The beekeeper should decide what increase he desires to make, and should prepare accordingly. Making up hives and frames is exasperating work if left till the bees are crying out for room, and it should be finished long before the actual time for increasing one's stock arrives. The beekeeper should also face the question of providing himself with stocks of foundation, and make arrangements for the treatment of his surplus wax by some neighbouring maker of foundation. The beekeeper should also decide on which market he wishes to place his crop, and lay his plans accordingly. It is advisable, too, that he consider the theoretical side of his occupation, and study, while the bees are in a dormant condition, the best methods of improving his stocks. Neither weather conditions, locality, nor any other factor will influence the honey-crop so much as strong colonies of bees, and the apiarist should endeavour, while he has the time, to ensure that these shall be in existence during the coming summer.

THE BEEKEEPERS' ANNUAL CONFERENCE.

A reminder may be given that the National Beekeepers' Association meets in conference in Wellington on 13th and 14th June. Notwithstanding the disorganization due to war conditions, it is expected that beekeepers from all parts of the Dominion will attend. Papers dealing with various phases of the industry are to be read. A display of beekeeping appliances and a practical demonstration with capping-melters will form a feature of the proceedings.

VITICULTURE.

S. F. ANDERSON, Vine and Wine Instructor.

THE VINEYARD.

PRUNING may be started this month with those varieties that lose their leaves early, such as Chasselas, Muscat Hamburgh, and the Pineaux. I say "may be" because in most parts pruning is more safely done a month later, but where hands are few and many vines are to be got over a commencement has to be made in good time to carry out the work. South of Auckland pruning should be three or four weeks later. Vines should not be pruned before the wood of the year is ripe—that is, when it has lost the green soft wood at the extremities. The wood should be of a brown or grey winter appearance, and there should be no sap-flow when a cut is made. The varieties to be pruned last are Cabernet Sauvignon, Malbeck, Riesling, and a few others.

Since the commencement of the war all manures have been more difficult to procure and costly to buy. It would be to the advantage of the vigneron to select a suitable place to burn the vine-prunings, where the ashes might be saved. Ashes are of very little use if allowed to be washed out with heavy rains, so that means should be provided for their being gathered up as soon as cool. Old casks would answer the purpose. The ashes could then be applied to the land as required.

We owe a great deal of the knowledge we possess respecting the mineral constituents of ashes of various plants to the late Professor Hilgard. With regard to the ashes of vines he has shown by analysis that in 100 parts there are 63·14 of potash, 9·05 of lime, and 10·42 of phosphoric acid. The ashes therefore have a value sufficient to warrant their being saved and distributed in the vineyard at the time of ploughing.

VINEHOUSE WORK.

Pruning may be commenced in the cool vinehouse as soon as the leaves fall. If mealy bug is present spread a cloth to catch the prunings and when rubbing off the loose bark. Gather up and remove for burning each lot before shifting the cloth under another lot of vines, going through the house in this way. As soon as all the vines are pruned and only the rods remain to handle, and before attempting to remove the rough bark, go over and touch with methylated spirits any of the white fluffy places that show the presence of mealy bug and their eggs. This will kill any of the insects and destroy the eggs. If this is not done there is a risk of spreading the pest when rubbing off the loose bark. The rods should then be washed with hot water from end to end, and the soil round the base cleared somewhat to expose any collection of the insect. Every part of the walls should be thoroughly cleansed. If the walls are brick or concrete they should be whitewashed. Washing thoroughly with hot water is quite effective, but, failing that, painting with clay and tar, as advised in the Department's Bulletin No. 40, is the most suitable preventive.

THE CELLAR.

The sooner the young wines, particularly the red, are separated from their lees the better—always choosing fine bright weather for this work. More urgency is required in the case of red, there being many substances in the lees, beside earthy matters introduced into the vats with the grapes, from which it is desirable to separate the wine, such as fragments of berries, stalks, and debris. These all afford a ready food for ferments and living organisms that might affect the quality of the wine.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

SMALL FRUITS.

PLANTING of small fruits may be done now or at any time during the next six or seven weeks, excepting that strawberries may be planted later, a matter that is affected by local conditions, also by the treatment given to the young plants. Plantations of bush fruits and others of similar perennial habit are of a more or less permanent character, and preparation work should be in accordance. Drainage should be good, and provided for by pipes, &c., if necessary. Plantations will not succeed in soil that becomes waterlogged every winter. The remarks in previous issues on the preparation of soil for vegetable-culture apply with equal force to small fruits. Before planting all straggling roots should be cut back, leaving a few inches of sound root. Whether they require shorten-

ing or not all the roots should be cut with a sharp knife or seccateurs. Bruised ends of roots always result in dying back, and prevent the formation of new roots. Tread the soil very firmly over the roots, leaving the surface soil loose. A suitable distance to plant bush fruits is 5 ft. apart.

Strawberries.

Strawberry-culture was the subject of an article in the March issue of the *Journal*, therefore it is not necessary to deal with it here further than to remark that plants just received from a grower require immediate attention to keep them in good condition. The bundle of plants should be opened up at once, and the plants separated and heeled in a plot of well-pulverized soil. The plants should not be laid in bundles, for however small the bundles may be they are almost sure to result in loss of roots by rot. Each plant should be laid in so that soil comes in close contact with its roots, and it should be trodden firmly against them. Provided these conditions are observed, the plants may be laid in as close to each other as may be convenient, and may remain until the soil is in a fit state for planting. Where spring conditions are dry it is best to plant as soon as possible, but if a fair amount of rain in spring is usual I consider it best to plant in July or August. Keeping the soil stirred to the last moment maintains it well aerated and prevents it becoming sour or pasty before active growth begins. The plants have a much better chance to do well when growth immediately follows planting. This is mainly due to the roots getting hold of the soil while it is in a sweet condition.

Red Currants.

A red-currant bush should have a clean stem of at least 6 in. or 8 in. between the surface of the soil and the base of the branches. Suckering should have been prevented by cutting out the buds when the cutting was made. Examine the roots, and if they show signs of suckering cut out the offenders before planting. Three branches are sufficient to start a bush with, and these should be placed at equal distances round the trunk. Cut out any other branches or growths of any kind that there may be, and reduce the three branches left to 6 in.

Pruning: The red currant bears its fruit on spurs on wood that is more than one year old, never on young wood. To be profitable a bush must bear fruit from bottom to top, and its habit is to do so, but to maintain vitality in the lower spurs it is necessary to secure to them a fair exposure to light and air. A cup-shaped bush with open centre is thus necessary. A bush is formed by annually shortening the leading branches to 6 in. when planted and to 10 in. the next two or three years, leaving them a little longer in after-years. Each year more shoots will be made than are wanted for leaders. Choose those best situated having an outward trend; two are wanted where there was one before. The reason for pruning the leaders longer after the first two or three years is to prevent them becoming crowded. An exact rule as to the extent of shortening should not be followed—judgment must be exercised. The lengths mentioned are right if the leaders ascend at a proper angle. If the tops are too close to each other the leaders must be left longer, and if they spread too much cut them shorter. No inside branches should be allowed. During summer numerous shoots are pushed out on all parts of the bush, so that notwithstanding it has a hollow centre

it soon becomes crowded with growth. A crowded condition prevents light reaching the lower spurs, and the strong growth, if left unchecked, would prevent development of fruit-spurs; therefore about midsummer all these shoots should be cut back to about 6 in. They will break into growth again, but the growth then made will not extend much. At the winter pruning all these shoots are to be cut down to short spurs about ¾ in. long. On no account reduce them to this extent in summer, as if it were done the lower buds which are to make fruit-spurs would break into growth, and at least a year would be lost. In the meantime the advancing leaders require some attention. It is unfortunate that our best varieties have a bad habit of growth. The leading shoots are prone to be very heavy, and they are given to curving downward and frequently are broken off by the wind. For these reasons it is often advisable to have recourse to topping to lighten them, though it is best to avoid this if it can safely be done without. It is, however, better to top these shoots than let them become crooked or blown off.

Red currants succeed in most parts of New Zealand, provided the right varieties are grown. Some varieties that have a good reputation in England and America are useless here. All the varieties that succeed with us are of the La Versailles type, including La Versailles, Cherry, Chenanceaux, Bertyn's No. 9, and Fay's Prolific.

Black Currants.

The range for growing black currants is more limited. They will not do where it is too hot, preferring a moderately cool climate, and more especially a strong moisture-holding soil—but, of course, not a badly drained soil.

The stem and branch borer has been a great bar to the growing of black currants. The borers have a strong liking for the wood, which is soft and easily penetrated. Many growers, in fact, have given up black currants because of the borer. Fortunately, the habit of this bush of bearing on young wood affords a means of combating these pests. When the cuttings are made all the buds should be left on. This causes the bushes to throw up stems from beneath the surface (a habit known as stooling), which makes it possible to replace branches attacked by borers. The better plan is to renew the branches by cutting out old ones, whether attacked by borer or not, when strong young branches become available. A crowded state must be avoided, but a hollow centre is not necessary.

Pruning, other than the removal of branches, as indicated, consists in cutting out weak branches and thin shoots, and shortening bearing-shoots by cutting off 2 in. or 3 in. of the immature tips.

Carter's Black Champion and Kentish Hero have been proved reliable varieties in a number of places. Boskoop Giant is new, and it comes with a great reputation for large berries and bunches and as a prolific bearer, but I have not yet seen it. There are other varieties reputed to be good, but with these, as with other bush fruits, I am recommending only those I know to be reliable.

Gooseberries.

Gooseberry-bushes should be trained to an open cup-shape as described for red currants, and suckering prevented. It is very hard to

manage a bush with several main stems. The main branches should be disposed regularly around the frame and not too close, none being allowed in the centre. Rigid restriction, as with red currants, is not desirable. The method answers in some places, but in the warmer parts of the Dominion it is bad, sometimes leading to the death of the bushes. Fruit is borne on every kind of wood—on last year's shoots, and on spurs on all other wood, including the main branches. Very gross shoots should be cut out, and also any that crowd the bush. On the lower parts of the bush the young shoots should be cut back to spurs ½ in. in length. Weak shoots in any position should be treated in the same manner. Stronger shoots should be shortened a little according to the room they have, and, to prevent crowding, older sub-branches that have become twiggy may be cut out.

For market work the favourite gooseberry is Farmer's Glory, a variety which bears a prolific crop of large berries and is easily gathered. Lions Provider is also extensively grown for market. The following are a few of the best varieties :—

Green : Green Overall, Gregory's Perfection, Marigold, Jolly Tar, Alarm.

Red : Billy Dean, Champagne, Crown Bob, Ironmonger, Ploughboy, Red Rough (for preserving), Roaring Lion, Whinham's Industry, St. Clair.

White : Alma, Whitesmith, Lady Leicester, Careless, Postman, Bright Venus.

Yellow : Broom Girl, High Sheriff, Pineapple, Drill, Gunner, Smiling Beauty.

Raspberries.

Raspberries do fairly well in most parts excepting the hottest districts. It is essential that the soil be fairly deep and moisture-holding ; they will not succeed on dry shallow soils. The usual arrangement is to set clumps of three, the plants being placed in a triangle and about 9 in apart ; the clumps 5 ft. apart from centre to centre, and rows 5 ft. to 6 ft. apart. The best plants are young suckers taken with a good ball of roots. Those that have not made a tall cane are best. When they are set out cut them down to about 6 in. Sometimes fruiting-canes are planted and a crop taken the first year. Such plantations do not last : they usually play out in three or four years, perhaps fruiting well the second year, but not much afterwards. The canes fruit the year following that in which they grow, then die. In winter the dead canes are cut out and the strongest of the new canes left for fruiting. Six to each clump is sufficient ; shorten these by about one-fourth of their length. During summer the soil between the rows should be kept clean by cultivation. In the rows a crowded state should be avoided by cutting out surplus suckers.

Varieties recommended are Antwerp, Fastolf, Northumberland Fillbasket, Northumberland Fillbasket Thornless, Semper Fidelis, and Superlative.

Loganberries.

This fruit is becoming more popular than raspberries. In England and America large plantations have been put in, and it is now one of the most important fruits. In plantations the vines are trained to post-and-wire fences, the top wire about 5 ft. high. Plants may be set 10 ft. or 12 ft. apart according to the quality of the soil. Like the raspberry, the canes bear fruit the season following that in which they

grow. Though the canes do not die after bearing, it is usual to cut them out and lay in new, as the young canes or rods bear the finest fruit. A sufficient number of the new rods should be preserved each year for this purpose. The loganberry does remarkably well trained to the wall of an outbuilding, though of course it must be on the sunny side. In such a position rods may be nailed in about 12 in. apart.

VEGETABLE-CULTURE.

June is a comparatively slack month in the vegetable-garden. Broad beans may be sown, and where cabbage and cauliflower plants from the autumn sowing are large enough they should be put out. Other work mainly consists in a general cleaning-up, digging, trenching, &c., in preparation for spring operations.

TURNIP-SEED-GROWING FOR FARMERS.

FARMERS would be well advised to reserve certain areas of their present turnip crops for seed purposes. Although there is every likelihood that abundant supplies will be available for October–December, 1918, sowings, the prospects for adequate oversea supplies for 1919 sowings are not very bright. This is especially the case with regard to yellow-fleshed Aberdeens and Imperial and Hardy Green Globe. Fortunately, it is just these varieties that have proved successful seed-producers in New Zealand when crops intended for feeding off have been held over and harvested for seed the following year.

The small-bird nuisance is the great limiting factor with regard to turnip-seed production, and if care is taken in guarding the crops from the setting to the ripening of the seed good crops are assured, at least so far as Otago and Southland are concerned. The question of utilizing a portion of our turnip crops for seed-production is being considered by certain merchants, but, apart from this, farmers should individually try and save at least a portion of their requirements. Farmers should also give every assistance to merchants who wish to carry on the work, either by contracting to grow the seed at a fixed price or by selling portion of their crops outright at a fair figure.

In the June number of the *Journal* the Biologist (Mr. A. H. Cockayne) will contribute an article on the growing of turnip-seed, giving the results of colonial experience and practical suggestions as to the management of seed crops.

It must be remembered that the present time, on account of the high prices ranging, makes it possible to establish turnip-seed-growing as a profitable venture for the farmer, even if the methods adopted are rather crude and the yields light. With the experience thus gained it will be possible to tell exactly whether, when prices again reach a normal figure, turnip-seed-growing can be added to our sale crops regularly grown on the farm. The uncertainty of Great Britain being able to supply us with full requirements for 1919 renders it imperative, if only from an insurance-policy point of view, to render the New Zealand farmer self-reliant so far as turnip-seed is concerned. The question of swede-seed-growing is largely governed by the prevalence or otherwise of dry-rot, but this is a matter that will be fully dealt with in the forthcoming article by the Biologist.

Some of the *Pinus halepensis* trees in the shelter-belts surrounding the orchard at Ruakura have died out. The failure of this species to do well is also noticed in other belts on the farm, which seems to indicate that the tree is unsuitable for the locality or its soils.

ANSWERS TO CORRESPONDENTS.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

FOOT TROUBLE IN SHEEP.

CHARLES JONES, Mangatu :—

My breeding-ewes are suffering with sores in the cleft of the hoofs. Their hoofs are not rotten; the sores are in the flesh in the cloven part of the foot. Some of the ewes are so bad that they graze on their knees. Could you inform me what the trouble is called and what causes it, also give me remedies for it if you know of any ?

The Live-stock Division :—

The trouble you describe is much the same as that often observed in cows, and is due to an inflammatory condition of the sensitive structure of the foot. We would advise you to run the affected animals through a 1-in-40 *non-poisonous* dip deep enough to cover the feet, allowing them to stand therein about one minute. The same day, if possible, run them through about 4 in. of water to which you have added 4 oz. of bluestone to the gallon. This treatment can be repeated, if necessary, in a week's time.

LATE DIPPING OF EWES AND RAMS.

"SUBSCRIBER," Raumai :—

Kindly advise me in regard to the late dipping of ewes. These ewes were put to the rams undipped on 11th March. Do you think it would be safe to dip both rams and ewes about the middle of May, weather being warm and dry ?

The Live-stock Division :—

We would not advise you to dip the ewes until the rams are taken out for the season, when you will be perfectly safe in dipping both ewes and rams any time during May. It is always advisable, of course, to select dry and mild weather.

LINSEED-GROWING.

O. SARRE, Waimumu, Southland :—

I propose sowing linseed on my farm here, and I would like some information about growing it. The ground is fairly good soil with a sandy clay bottom, and is in grass at present. Are the climatic conditions in Southland favourable for growing linseed ? If it is a success I propose to work the straw into hemp. Is there a market for linseed in the Dominion ?

The Fields Division :—

The climatic conditions in Southland are generally favourable for linseed-growing. The only trouble you are likely to experience will be from the depredation of birds, especially if the linseed, owing to wet weather after cutting, has to lie long in stook. The crop grows satisfactorily on any fair average soil. You should sow ½ to 1 bushel per acre, with 2 cwt. of superphosphate or grain-manure, in the beginning of October. The crop is easily handled with the binder. The seed commands a ready market in New Zealand at about £1 per bushel at present. We are experimenting just now on the utilization of threshed linseed straw for fibre purposes; but we do not think that you can look for any success in this direction.

WOOD-ASHES FOR INDOOR TOMATOES.

W. STEVENS, Henderson :—

Kindly let me know the best time to use wood-ashes in glasshouses for tomato-growing.

The Horticulture Division :—

It is suggested that the greatest benefit would be derived from the wood-ashes if they were applied as a top-dressing just before planting out the tomatoes, and scuffling them in with a long-toothed rake or manure-drag.

BLINDNESS IN SHEEP.

C. G. DE STE. CROIX, Coromandel :—

I recently found a four-tooth ewe on the run totally blind. She had a milky-looking skin over the eyeballs. I brought her in, and she recovered her sight in less than a week. Could you tell me the capse of the blindness, and if there is any way for a farmer to treat it if the sight does not come back naturally ?

The Live-stock Division :—

Blindness in sheep may be due to a variety of causes, the simple forms being due to colds, injuries, bush-fires, &c., or results of constitutional derangements. Such animals should be placed in a well-sheltered place, where the animals can avoid the light as much as possible. Local treatment consists of bathing the eyes with a 5-per-cent. solution of borate of soda once a day. When doing this see that the solution gets into the eye. Some forms of blindness are of a contagious nature, and the affected animals should be isolated where treatment could be adopted. In all cases of blindness the animals should not only be placed where they are sheltered from the weather and light, but where feed is plentiful, and given access to a salt lick. The treatment for contagious blindness is the same, but add to it a 1-per-cent. solution of creolin. It is advisable in all cases to administer 2 oz. of Epsom salts when first treated.

MANURE FOR LINSEED.

"INQUIRER," East Oxford, Canterbury :—

Kindly advise me as to the best manure to use for linseed, also the quantity to use per acre.

The Fields Division :—

In your locality you are recommended to use for linseed 1½ cwt. of superphosphate alone per acre.

CALVES DYING ON OLD LUCERNE.

F. W. M., Opawa :—

Kindly advise me regarding the following : Five calves were grazing on lucerne that was on the point of going to seed and was very tough and stalky. They appeared slightly drowsy, and three days later all were dead. The symptoms in this case were drowsiness followed by apparent madness and great pain. Is lucerne considered dangerous when in the above-mentioned condition ?

The Live-stock Division :—

Lucerne would undoubtedly be dangerous feeding for young stock when it has reached the stage you describe, as their internal organs are not then sufficiently developed to cope with what would even try those of full-grown animals. There is little doubt, therefore, that the calves died as the result of acute indigestion brought about by unsuitable feed. If when you first observed the animals ailing you had at once removed them to other feed and treated them with some laxative medicine good results might have followed.

TREATMENT OF REDWATER IN COW.

J. K. F., Maungatapere :—

I have a cow in milk and about six months gone in calf, which appears to have redwater. Her water is quite red, almost like blood, and has been in this state for quite three months. She seems in her usual state of health, and is giving quite as much milk as the rest. Please advise me if I should treat her in any way, or will she recover in time. Should I isolate her ?

The Live-stock Division :—

The evidence of redwater in this case can be safely put down to the digestive system being out of order, due to some of the feed obtained not being suitable for the time. A cow in this condition should first be given a bottle of raw linseed-oil into which has been well shaken an ounce of turpentine. Change the feed, and do not give her any roots or wet feed; but give hay, bran, crushed oats, or the like, and unless the kidneys have been organically affected the animal should be all right in a short time. There is no need to isolate the animal, there being no infection; but if any more of the cows develop the same symptoms the cause must be looked for upon the feeding-ground and the quality of the feed.

METHOD OF USING LINSEED-OIL CAKE.

Arthur T. Roberts, Kai Iwi :—

What is the best way to use pressed linseed-oil cake ? Should I soak it or scald it ?

The Fields Division :—

The usual way of using linseed-oil cake is to put it through a cake-crusher, which reduces it to a size varying from coarse meal to small nuts. It is not necessary to soak or scald the cake.

FOWLS AND FLYING-ANTS.

C. W. Babbage, Wanganui :—

For two or three years past I have had hens suddenly die about March. I opened the crop of one and found it full of insects like flying-ants, and have sent the latter in a separate bottle. No doubt the remedy is to keep the fowls shut up, but it would be interesting to know if they are poisoned.

The Live-stock Division :—

On examination the insects sent proved to be flying-ants, which were no doubt responsible for the death of your birds. The ants are not poisonous, and may be eaten by fowls without injurious effect, but if while being swallowed they sting the bird's throat a swelling is caused which results in death by suffocation. There is no remedy other than to keep poultry confined while the ants make their visitation.

TREATMENT OF SCALE ON LEMON-TREES.

"Settler," New Lynn :—

What treatment do you advise for scale on lemons ? Does the scale affect the vitality of the tree ?

The Horticulture Division :—

Fumigation with hydrocyanic-acid gas is in all cases the most effectual for citrus trees. Being evergreen, a spray mixture of sufficient strength to kill the mature scale would be likely to injure the trees. Spraying, however, is the means most frequently adopted. It is thought best to attack the young larvæ, as the strength of wash that will kill them will not injure the tree. Red oil, 1 in 35 or 40, is recommended. Young scale may be looked for early in summer, but they do not hatch out regularly, and some hatch later. It is advisable to observe the insects through a lens. In any case, several sprayings every year are necessary. Scale insects live by sucking the sap of the trees. The vitality of the tree is affected according to the numbers of the insects, even to the extent of the tree being killed.

COW WITH LEUCORRHŒA.

"NEW CHUM," Tinwald :—

I have a cow which calved nine weeks ago, and has a discharge of a sort of white slime at intervals of two or three days. She is a Holstein, in good condition, bright, with good appetite, and milking well. I will be obliged if you can help me with advice.

The Live-stock Division :—

The animal is evidently suffering from leucorrhœa, due in all probability to neglect at time of calving. The following treatment should be adopted: With a pair of horse-clippers remove all the hair from off the tail except the brush, also from the escutcheon right up to and around the root of the tail, and keep these parts clean by the use of disinfectants. Wash out the womb once a day with as much water as it will take in. The water should be boiled and allowed to cool to blood-heat; then add 1 oz. of soap and 1 oz. of hyposulphite of soda to each quart of water so used. The animal should have access to a salt lick. Leucorrhœa, when of long standing, is sometimes most difficult to cure, and you may have to adopt other measures.

PROTECTING VEGETABLE-SEEDS IN GROUND.

"FARMER," Matakana :—

Is there any method of treating vegetable seeds to protect them against attacks in the ground by insects ?

The Horticulture Division :—

Seeds can be protected from birds or injury below the surface of the ground by covering them with red-lead, or by immersing them in turpentine or kerosene. To use red-lead damp the seed with water, place a little dry red-lead in a tin, throw the seed in, and shake it about till covered. For the other method place the seed in any convenient vessel and pour on it sufficient turpentine or kerosene to cover. The seed need not be left more than a few minutes in the liquid.

COW FORAGE.—A THREE-YEAR LEA.

J. W. T., Katea :—

1. In the February issue of the *Journal* (page 117) you advise the growing of Western Wolths and red clover for cow forage, mentioning the uses of the forage up to February. Will you please say whether the economical use of the paddock would be limited to February, or would it pay to leave it in grass, say, till the spring, and then put in turnips ?

2. Will you kindly suggest a grass-mixture for a three-year paddock for cows ?

The Fields Division :—

1. Western Wolths rye-grass is practically done after the first winter and summer grazing. For good feed in the second winter substitute Italian rye-grass, using the same amount of seed.

2. It is somewhat debatable whether the rye-grasses and clovers should be used for a three-years lea alone or with the addition of some of the more permanent grasses. But we certainly think some timothy and cocksfoot should be included in your locality. The following mixture is suggested: Italian rye-grass, 5 lb.; perennial rye-grass, 20 lb.; cocksfoot, 4 lb.; timothy, 2 lb.; red clover, 3 lb.; alsike clover, 1 lb.

CROSSBREEDING DUCKS.

E. H., New Lynn :—

Will you please inform me whether the cross of Pekin drake with white Aylesbury ducks is a good one ?

The Live-stock Division :—

The progeny of this mating should possess excellent table qualities, but if egg-production is the objective the crossing of a Pekin drake with Indian runner ducks is more to be recommended.

APPLE-TREES AFFECTED WITH WOOLLY APHIS.

"WAIRARAPA," Martinborough :—

I have some Stone Pippin apple-trees badly infested with woolly aphis, and am thinking of either cutting them out or regrafting with some other variety not so subject to the aphis. Which plan would you advise ? I would also like you to name a few kinds of apples, late keepers not greatly subject to woolly aphis, either cooking and dessert, or dessert.

The Horticulture Division :—

You may satisfactorily top-work your trees with a blight-resistant variety, but if they are old and badly affected it would no doubt be better to grub them out and replant. The following varieties are blight-proof or highly resistant, and should suit your purpose for either planting or reworking : Willie Sharp, Lord Wolseley, and Delicious.

RUBBER-TREES AND PINEAPPLES.

JACK LUCAS, Mangere :—

Kindly inform me whether rubber-trees could be grown with any hope of success in the North—say, about Mangonui. Also, would pineapples do any good there ?

The Horticulture Division :—

The "rubber-tree" (*Ficus elastica*) will grow indifferently well in some parts of New Zealand, but a tropical climate is necessary to induce the luxuriant growth and copious flow of sap required for the production of rubber. No part of New Zealand has a sufficiently hot climate to grow pineapples.

"WATER-CORE" OF APPLES.

"ORCHARDIST," Kinohaku :—

What is the cause of clear watery spots in apples ? My orchard is situated on a damp flat.

The Horticulture Division :—

The watery spots in apples are the condition known as "water-core," the watery appearance being usually most pronounced around the core. The cause of water-core is not well understood. It is most prevalent on young trees, and is rarely present on trees after their wood has become hardened and growth steadied by free bearing. No preventive measures are known.

NOTICE.—An answer cannot be given to "Settler," Matanui (regarding orchard-planting), unless he supplies his name to the Editor.

FORTHCOMING SHOWS.

Otago A. and P. Society : Winter Show, at Dunedin, 28th to 31st May.

Waikato Winter Show Association : Show, at Hamilton, 4th to 8th June.

Manawatu and West Coast A. and P. Association : Winter Show, at Palmerston North, 18th to 21st June.

South Taranaki Winter Show Company : Dairy Show, at Hawera, 1st to 6th July.

ASSISTANCE TO WHEAT-GROWERS.

Farmers or others willing to grow wheat this season, but requiring financial backing in connection with the purchase of seed and [or] manure, are invited to send an application to the Fields Supervisor for their district. The application should be addressed to the Fields Supervisor at Auckland Hamilton, Napier, Wanganui, Weraroa (for Wairarapa, Manawatu, Wellington, Marlborough, Nelson, and Westland), Christchurch, Timaru, Dunedin, or Invercargill, as the case may be.

After making any necessary inquiries, and on being satisfied that the proposal is suitable, the Fields Supervisor will supply the applicant with a letter guaranteeing, on behalf of the Department, payment *after the harvest* to any merchant or other vendor for the quantity of seed-wheat and [or] manure shown in the application: provided the price charged for the seed-wheat is according to the regulations, and provided the price for the manures is the ordinary rate ruling at the time they are supplied. On receipt of the Government guarantee the applicant can forward it to any merchant or other vendor, and make his own arrangements with him.

Full particulars and forms of application can be obtained at any of the principal offices of the Department.

Wheat and Oats Threshings.—According to a statement issued by the Government Statistician, returns of actual threshings throughout the Dominion received up to 15th April from threshing-mill owners show that till then 2,663,067 bushels of wheat and 1,894,696 bushels of oats had been threshed out. The Dominion average yields per acre in cases where particulars of areas were furnished worked out at 25·46 bushels for wheat and 32·03 bushels for oats. On these threshings, in wheat Canterbury averaged 25·42 bushels, Otago 27·28 bushels, Southland 26·38 bushels, Marlborough 19·31 bushels, and Wellington 20·21 bushels. In oats Canterbury averaged 27·59 bushels, Otago 36·12 bushels, Southland 45·64 bushels, Marlborough 28·53 bushels, Hawke's Bay 32·98 bushels, and Wellington 31·21 bushels.

Retail Price of Wheat.—An Order in Council dated 7th May, 1918, fixed the maximum price of wheat inferior in quality to good milling-wheat, when sold by any person other than the grower, at the same price as that payable for similar wheat when sold wholesale by millers, brokers, or other purchasers from the growers, f.o.b. Lyttelton, with an addition of 15 per cent., together with a further addition of the transit charges actually paid by the retail seller of such wheat.

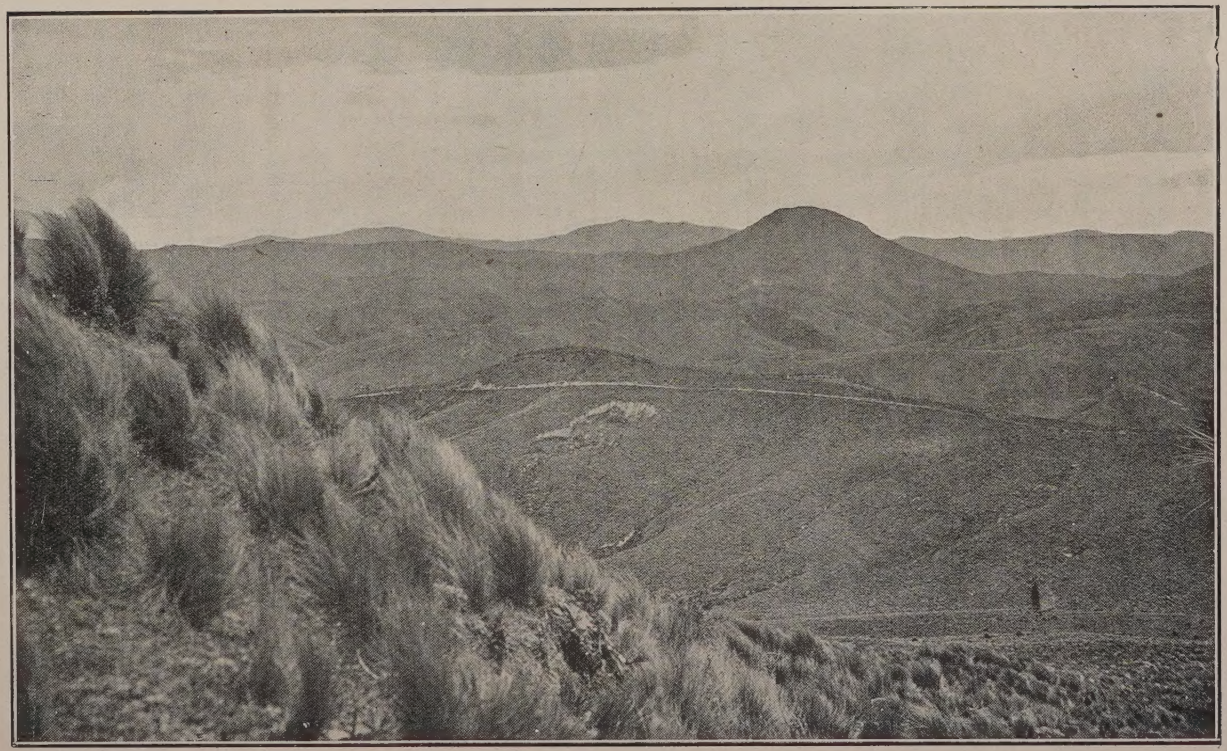
Prices of Flour, Bran, and Pollard.—An Order in Council dated 16th April, 1918, fixed the maximum prices of flour, bran, and pollard as follows: As sold by the manufacturer, on the basis of f.o.b. Lyttelton, Timaru, or Oamaru—Flour in 200 lb. sacks, £15 10s. per ton; bran, £5 10s. per ton; pollard, £7 10s. per ton. When bran or pollard is sold by other than the manufacturer an addition of 10s. per ton in the case of bran and 15s. per ton in the case of pollard is allowed on lots of half a ton or over, and additions of 12s. 6d. and 17s. 6d. respectively for lots under half a ton. Power is given to the Board of Trade to authorize the sale of flour, bran, or pollard at prices above such maximum prices in any specified locality by any specified seller.

In a *Gazette* dated 16th April, 1918, it was notified that the Government had ceased to purchase hides and calf-skins; also that the purchase of butter by the Government was being suspended.

Leaf-roller caterpillar has been declared a disease under the Orchard and Garden Diseases Act, and is now included in the Second Schedule of the Act.

MEAT-FREEZING WORKS IN NEW ZEALAND.

Name and Address of Company. *Land District.*	Location of Works.	Beef-killing Capacity per Day.	Sheep-killing Capacity per Day.	Storage Capacity, in 60 lb. Carcases Mutton.
Auckland.				
Whangarei Freezing Company, Ltd., Auckland ..	Whangarei Hds.	150	1,000	112,695
Auckland Farmers' Freezing Company, Ltd., Auckland	Southdown ..	200	3,000	126,000
" " " "	Horotiu ..	200	3,000	66,000
Westfield Freezing Company, Ltd., Auckland ..	Westfield ..	200	3,000	205,000
R. and W. Hellaby, Ltd., Auckland	" ..	120	500	3,000
East Coast Co-op. Freezing Company, Ltd., Whakatane	Whakatane ..	200	1,000	80,000
Hawke's Bay.				
Wairoa Farmers' Co-operative Meat Co., Ltd., Wairoa	Wairoa ..	50	2,000	125,000
North British and Hawke's Bay Freezing Company, Ltd., Napier	Westshore ..	40	1,500	36,000
Thomas Borthwick & Sons (Aus.), Ltd., Christchurch ..	Pakipaki ..	30	1,500	72,000
Nelson Bros., Ltd., Tomoana	Tomoana ..	80	3,000	152,000
Hawke's Bay Farmers' Meat Company, Ltd., Hastings	Whakatu ..	80	2,000	75,000
Tokomaru Sheep-farmers' Freezing Company, Ltd. ..	Tokomaru Bay	45	2,500	60,000
Poverty Bay Farmers' Meat Company, Ltd., Gisborne	Kaiteratahi ..	100	2,000	120,000
Gisborne Sheep-farmers' Frozen Meat Company, Ltd., Gisborne	Kaiti ..	150	6,000	250,000
Nelson Bros., Ltd., Gisborne	Taruheru ..	85	2,500	82,000
Taranaki.				
Taranaki Farmers' Meat Company, Ltd., New Plymouth	Smart Road ..	100	2,000	60,000
Thomas Borthwick & Sons (Aus.), Ltd., Christchurch ..	Waitara ..	200	2,000	90,000
New Zealand Farmers' Co-operative Bacon and Meat Packing Company, Ltd., Wellington	Eltham ..	75	..	30,000
Patea Farmers' Co-op. Freezing Company, Ltd., Patea	Patea ..	120	1,000	52,000
Wellington.				
Wanganui Meat-freezing Company, Ltd., Wanganui..	Castlecliff ..	100	2,200	100,000
New Zealand Refrigerating Company, Ltd., Christchurch	Imlay ..	200	6,000	250,000
Otaihape Farmers' Meat Company, Ltd., Taihape ..	Winiata ..	50	1,200	95,000
Feilding Farmers' Freezing Company, Ltd., Feilding ..	Aorangi ..	100	2,200	170,000
National Mortgage and Agency Company of New Zealand, Ltd., Dunedin	Longburn ..	60	1,500	87,000
Wellington Farmers' Meat Company, Ltd., Masterton	Waingawa ..	250	6,000	270,000
Gear Meat Preserving and Freezing Company, Ltd., Wellington	Petone ..	100	10,000	300,000
Wellington Meat Export Company, Ltd., Wellington..	Ngahauranga ..	120	8,000	240,000
" " " ..	Kakariki ..	100	2,000	90,000
Marlborough.				
New Zealand Refrigerating Co., Ltd., Christchurch ..	Picton ..	30	1,000	23,000
Nelson.				
Nelson Freezing Company, Ltd., Nelson	Stoke ..	..	350	30,000
Canterbury.				
Canterbury Frozen Meat Company, Ltd., Christchurch	Belfast ..	50	7,000	195,000
" " "	Fairfield ..	..	4,000	100,000
" " "	Pareora ..	25	4,500	183,000
New Zealand Refrigerating Co., Ltd., Christchurch ..	Islington ..	50	7,000	355,000
" " " ..	Smithfield ..	50	6,000	186,000
North Canterbury Sheep-farmers' Co-operative Freezing Company, Ltd., Christchurch	Kaiapoi ..	50	2,500	175,000
Thomas Borthwick & Sons (Aus.), Ltd., Christchurch ..	Belfast ..	..	4,000	60,000
Otago.				
New Zealand Refrigerating Co., Ltd., Christchurch ..	Pukeuri ..	..	3,000	200,000
" " " ..	Burnside ..	50	3,500	216,000
South Otago Freezing Company, Ltd., Balclutha ..	Finegand ..	30	1,200	175,000
Southland.				
Birt and Co., Ltd., Invercargill	Ocean Beach ..	100	2,500	110,000
Southland Frozen Meat Company, Ltd., Invercargill..	Mataura ..	50	2,000	87,000
" " " " ..	Makarewa ..	70	2,000	14,000
" " " " ..	Bluff ..	..	..	114,000
Total	..	3,860	129,150	5,621,695



Southern Pastoral Country.